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OF THE

KNEE-JOINT.

THE TREATMENT

OF

INTERNAL DERANGEMENTS

OF THE

KNEE-JOINT

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BY

HERBERT WM. ALLINGHAM, F.R.C.S.

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PREFACE.

DURING the time that I was actively connected with St. George's Hospital I received much consideration and kindness from the medical and surgical staff of that institution. While working under them I was allowed many facilities for original research which have been, and will be, invaluable to me in my surgical career. The experience thus obtained has largely aided me in the preparation of this book on the Internal Derangements of the Knee-Joint. I am also indebted to the curators of the Anatomical Museums of the London Hospitals for the courteous manner in which they have assisted me in my investigations, and am especially beholden to Dr. Penrose, of St. George's Hospital, and to Professor Groves, of King's College Hospital.

It will be seen that in these pages no attempt has been made to draw any definite conclusions from the statistics of operations on the knee-

joint; for, as often as not, successful cases are alone published, whilst the no less interesting failures are left unrecorded. Averages struck from statistics formed in such a manner can be of no practical use.

Nevertheless, the collection of cases here narrated may tend to establish the statement that, if proper precautions be taken, the knee-joint may be opened with little danger of untoward results.

It is right to add that some of the figures in the text are merely diagramatic, and do not pretend to fully depict the structures which they only serve to delineate.

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Nov. 1889.

INTERNAL DERANGEMENTS

OF THE

KNEE-JOINT.

INTRODUCTION.

In common with most other arts and sciences, surgery has of late years shown a marked tendency to extend its boundaries. In former times, when skill was sometimes lacking, knowledge often deficient, anæsthetics unused, and surgical appliances few in number and faulty in construction, operations were only resorted to when they were thought to be absolutely necessary. The saving of life was then the chief object of surgery, and patients, whose maladies were not positively dangerous or completely disabling, were enjoined to bear their comparatively trifling pains, or even considerable discomfort, as best they could. To undergo an operation, when the o[illegible] and

imperative, was considered almost as a tempting of Providence. In fact, what we may term operations of convenience were scarcely dreamed of, and most rarely attempted. Now, however, a change has come over the scene; life is lived at higher pressure, and competition is greater than it used to be; anything that clogs the wheels of life entails on the sufferer loss of health, of time, and of money, incapacitates him for some occupations, and debars him from some pleasures. Such matters are too valuable to be trifled with; the province of surgery is now, not only to save life, but to dispel discomfort.

Among the most troublesome and vexatious of minor disorders, internal derangements of the joints may be fairly classed. Jaw, hip, elbow, shoulder may all of them suffer from such derangements, but the knee-joint, from its complex structure, is especially liable to affections of this nature. It is, therefore, of internal derangements (*not* constitutional diseases) of the knee-joint that I propose to speak in this book; new growths formed in the synovial membrane, fluid in the joint, slipped, detached, or broken portions of, semilunar cartilages, &c., will all find their due place in these pages. But I wish it to be clearly understood that I do not intend to deal

with the minute pathology or the minute anatomy of these internal derangements, nor shall I enter into any of the current disputes as to their origin. The main questions will be, when are these disorders of the knee-joint likely to be remedied by operative treatment, and how are such operations to be performed; these topics will be investigated in as practical a manner as possible, and whatever theories I may broach, which in some instances require more cases for their absolute proof, will be directed towards the attainment of essentially practical ends.

Most surgeons in the course of their daily work are familiar with cases of so-called sprain of the knee-joint. The tale that the patient generally has to tell is, that after some slight accident, such as suddenly turning round or catching his toe, he has experienced acute pain in the knee-joint, followed by swelling. At first little notice may be taken of this by the patient or by his medical attendant; after a rest the swelling subsides, and the patient is able to return to his work. In a short time, however, the symptoms recur, sometimes accompanied by effusion; more rest is enjoined, a lotion is ordered, matters appear to progress favourably, and work is resumed; a little later there is another slight twist, the knee

becomes swollen and painful, and again the patient has to lie up, probably with his leg on a splint. The joint may be painted with iodine, or a blister be applied, apparently with success. The patient is allowed to go out, perhaps wearing an elastic knee-cap, till, once more there is the twist, and its annoying consequences. Naturally enough, the subject of these discomforts begins to grow weary of such a state of things—the slightest unguarded movement causes him pain, his doctor appears to be doing him no good; he takes counsel with his friends, and perhaps falls into the hands of some quack. A bone is said to be "out," and a course of manipulation and shampooing is recommended; this is continued until the sufferer, with exhausted patience and deplenished pocket, comes to see that he has not obtained, and does not seem likely to obtain, any benefit. The knee is still painful and discomforting.

He turns for aid to an instrument maker, and obtains a splint, which, if it is efficient, limits to some extent most movements of the joint. He asks himself, in perturbation, "Am I to go through life always wearing this somewhat cumbersome apparatus? Am I to become a confirmed cripple? Am I never to join in any active and invigorating sports?" With feelings almost akin to despera-

tion, he now perhaps consults some surgeon, hoping that in that quarter at least he may be able to obtain relief. But no! he only gets cold comfort, probably after this fashion: "There is something wrong with your knee; what it is, no one can say positively. I am afraid you will have to put up with the discomfort. Have the joint opened? Certainly not; the operation might be most dangerous, and I should not like to answer for the consequences. It would probably do you no good, and might necessitate amputation of the leg, or at any rate leave you with a stiff joint for the rest of your life. Make up your mind to grin and bear it." In this manner the patient may turn from pillar to post. Could a more unsatisfactory state of affairs be possibly conceived?

As surgeon to the Surgical Aid Society I have had numerous opportunities of observing such cases of internal derangement of the knee-joint in which no real cure has been effected. Time after time people have come to me with the same lamentable tale. They have been thrown out of their regular employment, and have been recommended to seek some light work. Could I supply them with a splint by the aid of which they may be able to earn their livelihood? The apparatu which they desire is usually cumbersome, a

but feebly efficient; it cannot cure the affection. The observation of a good number of these cases altogether disheartened me with the oftimes unduly cautious treatment. I resolved, then, in chronic cases, in which patients could only walk with the use of splints, and then at best in a very unsafe manner, to open the joint, and, if possible, find out the cause, and remedy their local inconvenience.

Now, the very mention of such a proposed procedure would cause many people to hold up their hands in horror; all the supposed dangers set forth above would be marshalled and reiterated and recapitulated, and the rashness and folly of the operator would be strongly condemned. Yet the knee-joint has been opened, and, as will be shown in the cases to be narrated, perfectly successful results have been obtained without the patient incurring any of those serious consequences which have been so deeply dreaded. In my opinion, this fear of dangerous results, and the timidity which has thus arisen in the minds of some, have gravely influenced the study of these lesions of the knee-joint. They have been ascribed to unknown causes, and, as operative procedure was the only mode in which knowledge could be ob-

tained, research and investigation have been materially hampered. Internal derangements of the knee-joint have been virtually neglected, and have failed to receive from most of the profession that consideration which they really deserve. This book, perhaps, may enable the operative treatment of these affections to attain a more sound and safe position in the province of surgery.

Other branches of the art have before now suffered from a like timidity and lack of enterprise. Some years ago the practice of opening the abdomen was stigmatised as unwarrantably rash and even foolhardy. Yet the determination and energy of surgeons in that branch of work have succeeded in dispelling such superstitions, and in relegating them to the limbo of other exploded delusions. No one now hesitates for one moment to open the abdomen for the removal of an ovarian tumour or diseased appendices. Though these operations may take a considerable time to perform, and the patients may be exhausted and wasted by their disease, yet in the majority of cases a succe[illegible] issue has been reached, and the suffer[illegible] been benefited. But why? Because [illegible] been treated by men who have been bol[illegible] to lay aside the trammels of tradition, t[illegible] themselves, and to translate their tho[illegible]

acts. I venture to hope that in the same manner all superstitious fears with regard to the opening of the knee-joint may eventually be overcome, and be finally banished from the minds of the profession.

I regard the synovial membrane of the knee-joint just as I do the peritoneum; both of them are serous sacs, and require clean and thoughtful handling. Let the same care, patience, and attention to detail be applied to the knee-joint as have been bestowed on the far larger and more complicated serous sac, the peritoneum, and the same beneficial results may follow. If this course of action be pursued, cases of obscure derangements of the knee-joint will not be obliged to wander from practitioner to bone-setter, thence to the instrument maker, and again to a surgeon who refuses to operate. Patients will not have to pass through life in a sometimes crippled state, and with constant discomfort; they will be spared worry, freed from expenses, and, best of all, will be able to regain the perfect use of the limb.

In studying the literature of this subject, I can find little mention of the more chronic of these derangements, an omission which I imagine to be due to their supposed incurable nature. The most persistent attempt to remedy these maladies has

been made by Professor Annandale, who has written two able papers on the subject, and has cited cases in which he has operated with success. Besides my own cases, I find a few scattered instances narrated by other surgeons. The discussion which I propose to offer in these pages may tend to bring the matter more fully before the attention of the profession in general. By the avoidance of *constitutional diseases of the knee-joint*, and of minute questions of pathology and anatomy, I shall be enabled to concentrate my efforts on the more urgent and practical portions of the theme. The following chapters will embrace all my observations, and I shall have achieved my desire if I succeed in showing that the risks of opening and exploring the knee-joint can be minimised, if not altogether done away with, and if I induce others to adopt modes of operative procedure which will greatly benefit a large class of sufferers. Good results in this quarter may throw light on the naturally somewhat different methods to be pursued with regard to the internal derangements of other joints of the body.

CHAPTER I.

THE INTERNAL AND EXTERNAL SEMILUNAR CARTILAGES.

As the internal and external semilunar cartilages are the most generally recognised causes of internal derangements of the knee-joint, I take them first on my list. A brief description of their anatomy will tend to explain the causes, diagnosis, and treatment of the lameness occasioned by any malposition or slipping of these cartilages.

The internal and external semilunar cartilages are crescentic laminæ of fibro-cartilage attached to the margin of the head of the tibia, and serve to deepen its surface for articulation with the condyle of the femur, and to act as buffers in any jarring of the joint. The circumference of each cartilage is thick and convex; their lower surfaces are flat. Each cartilage covers about half of the corresponding surface of the tibia, leaving the inner part uncovered.

The *internal semilunar* cartilage is somewhat semi-

circular in form, elongated from before backwards, and broader behind than in front. Its anterior extremity is thin and pointed, and is firmly implanted in a depression in front of the inner articulation of the tibia; its posterior extremity is fixed into the depression behind the spine of the tibia. The circumference of the cartilage is united to the internal lateral ligament and to the head of the tibia by the coronary ligaments.

The *external semilunar* cartilage is more circular in shape. Its extremities are firmly implanted in depressions in front of and behind the spine of the tibia, and at their insertion are interposed between the attachments of the internal cartilage. Its circumference is grooved at its outer side by the tendon of the popliteus muscle, and is attached to the head of the tibia by means of the coronary ligaments.

The *coronary ligaments* which bind the external and internal semilunar cartilages to the head of the tibia may be regarded as little bands of fibrous tissue, which are more or less slack to allow the cartilages some range of movement. The external coronary ligament is pierced by the tendon of the popliteus, which here makes a weak point and therefore renders it liable to rupture.

Stretching across the upper

and extending from one semilunar cartilage to the other, are accessory bands of fibres, sometimes few, sometimes many; these are termed the *transverse ligament.* The question as to which cartilage is the starting point of these bands is differently answered by the various authorities. Scott Lang asserts that the transverse ligament is part of the internal cartilage, and that its outer fibres are attached in a weak and ill-defined way to the capsule of the joint and the coronary ligament of the external cartilage. In the last edition of *Gray's Anatomy* just the reverse of this is given. However, it is not of much importance. It is enough for us to say that, as the transverse ligament varies in size and strength, so, too, inversely, will there be a variation in the anterior cornua of the internal cartilage. The matter of most weight is that the transverse ligament may sometimes be absent; the absence or existence of this ligament may in some manner tend to explain the displacements of the cartilages presently to be described.

It is stated in many works on anatomy that these semilunar cartilages are fixed on the top of the tibia; but Goodsir (*Anatomical Memoirs*, vol. ii. p. 227) says that the internal semilunar cartilage must be considered to be an appendage

of the internal head of the tibia, and that the external semilunar cartilage is an appendage of the external condyle of the femur, with which it moves, backwards in flexion, forwards in extension. Both cartilages, however, are firmly fixed to the tibia by their cornua, and, as Scott Lang says, might be regarded as altering their shapes and positions to receive the condyles of the femur, somewhat in the manner in which an ellipse is formed by a piece of cord or an elastic band fixed at two points. The nearer the points of attachment the greater will be the range of movement; therefore, on account of its circular form and the approximation of its cornua, a wider range of movement is permitted to the external cartilage. On the other hand, in consequence of the wider separation of its horns, the internal cartilage possesses a more restricted range. I have purposely gone rather fully into the description of these semilunar cartilages and their attachments, and into the question as to which bone it is, the tibia or the femur, with which they are directly related. From the above it should be clearly understood that they are cartilaginous rings, and are moved somewhat and slightly altered in shape during flexion and extension of the leg.

In a work of this kind I do not intend to

enter minutely into the mechanism of the very complicated movements of the knee-joint. I must therefore refer those who may be particularly interested in the matter to the valuable articles by Goodsir (*Anatomical Memoirs*, vol. ii.). For all practical purposes, the following summary of the movements will be found to be sufficient.

The knee-joint is capable of free flexion and extension, and during these movements different parts of the condyles of the femur rest on different portions of the tuberosities of the tibia. Again, as the femoral condyles vary somewhat in breadth, being rather narrower in front than behind, they must alter by direct pressure the shape of the semilunar cartilages. It is also well to remember, that during the first third of flexion and the last third of extension, from the shape of the component parts, and for the sake of greater firmness about the joint, there is some slight *rotation* of the tibia, *inwards* in flexion and *outwards* in extension. From this it will be understood that when the leg is beginning to be flexed on the thigh, besides this flexion there must be, and is, some slight rotation *inwards* of the foot and leg. Again, when the leg is being extended to the utmost on the thigh, not only is there extension, but there must be some rotation

outwards of the foot and leg on the thigh. Once more, when the leg is midway between extension and flexion, the component parts of the joint are in such a position as to allow of considerable *rotation* of the tibia on the femur inwards and outwards, and, at the same time, from the ligaments being lax and loose in this position, some slight amount of *eversion* or *inversion* of the leg on the thigh is permitted. It will be agreed that this is a simple enough account of the movements of the knee-joint. Thus a complicated movement of the femur and tibia takes place, even if the semilunar cartilages are removed from the joint.

It can therefore be seen how much more complex the movements of the joint must be when the semilunar cartilages (themselves being movable) are placed between the tibia and femur.

What, then, takes place on every action of the joint? The femur moves on the tibia in flexion and extension, and alters its relations with it. The tibia, too, is going through some amount of *rotation*, either inwards or outwards. Added to this, we have the *semilunar cartilages*, altering their relations both with the head of the tibia and with the condyles of the femur. Then, if any violent movement or sudden twist occurs before

the muscles, governing this joint and keeping its component parts in unison, have power to act, the complicated mechanism of the joint may be thrown out of gear, and from a cartilage moving too quickly or too slowly, or a condyle moving too slowly or too quickly, great damage may arise. The cartilage may be pinched and only momentarily displaced in relation to the femur or tibia, and there the trouble may end. On the other hand, some parts of the attachments of the cartilages may be torn or stretched, and so allow of one of the internal derangements, presently to be explained. All this may occur, even in a healthy joint. But let us suppose that from a blow, followed by effusion, the ligaments become slack; then, just as in complicated machinery, unless the gearing is kept taut and each individual portion strictly fulfils its functions, the whole apparatus will jam and easily get out of order; so here, too, from a slight injury, which causes effusion and slackening of the important parts of the complex mechanism of the knee-joint, the entire structure may be thrown out of working order, and a persistent and troublesome derangement may arise.

Mention will here be made of all the instances I have been able to find of displacements of the

semilunar cartilages. These will include specimens from the post-mortem and dissecting rooms, and cases that have been operated on. The cases will not be cited in full. I only propose to call attention to the *pathological* conditions of accidents which have actually occurred. After that I shall attempt to tabulate the kinds of lesions to which the semilunar cartilages are liable.

INTERNAL SEMILUNAR CARTILAGES.

CASE I.—Mr. Annandale, in the *Brit. Med. Journ.*, April 18, 1885, reported a case in which "the internal semilunar cartilage had been completely torn away from its anterior attachment, and was displaced backwards about half an inch."

CASE II. Mr. Annandale, *Brit. Med. Journ.*, Feb. 12, 1887.—In this case "the internal semilunar cartilage had been almost entirely torn away from its anterior attachment, and was folded backwards upon itself, lying towards the intercondyloid notch."

CASE III. Mr. Annandale, *Brit. Med. Journ.*, Feb. 12, 1887.—Here it was found that "the internal semilunar cartilage was partially separate at its anterior attachment."

CASE IV.—Mr. Annandale, *Brit. Med. Jou*

Feb. 9, 1889, recorded a case in which he removed a cartilage where, in addition to a tongue-like portion of it which had been partially torn away, the body of the cartilage itself was thickened, and undergoing a form of fatty degeneration.

CASE V. Herbert Wm. Allingham, *Clin. Soc. Reports*, 1889.—I found that "the internal cartilage had been torn away from its anterior attachment, and was resting upon the inner side of the internal condyle of the femur."

CASE VI. Herbert Wm. Allingham, *Brit. Med. Journ.*, 1886, p. 1110.—In this "the internal cartilage was abnormally movable over the head of the tibia, both forwards and outwards."

CASE VII. Herbert Wm. Allingham, *Gt. North. Hosp. Reports*, Jan., 1889.—"The internal semilunar cartilage was very movable at its anterior part, and could be pushed into the joint."

CASE VIII. Herbert Wm. Allingham, *Gt. North. Hosp. Reports*, March, 1889.—In this case "the internal semilunar cartilage was very freely movable on the head of the tibia, but could not be raised from it."

CASE IX.—Mr. Brodhurst, *St. George's Hosp. Reports*, 1867, describes a case in which "the internal semilunar cartilage had been torn away from its anterior attachment."

CASE X.—Mr. Edmund Owen, *Brit. Med. Journ.*, Nov. 24, 1888, reports that in one instance "the front end of the internal semilunar cartilage was found to be loose, and curled into the gap between the condyles of the femur and the tuberosities of the tibia."

CASE XI.—Dr. Lediard, *Path. Soc. Trans.*, 1888, speaks of the removal from the knee-joint "of a piece of internal semilunar cartilage, which was torn away at one end." The particular end was not specified.

CASE XII.—Sir William Ferguson, *Practical Surgery*, 5th edit., describes a dissecting-room case, in which "either the internal or external semilunar cartilage was displaced from its coronary attachments, and was turned up into the intercondyloid notch." The extremities were perfectly normal.

CASE XIII.—Mr. Croft, *Clin. Soc. Reports*, vol. xxi. p. 160, reports a case in which he found that "the internal semilunar cartilage was fixed by its anterior and posterior extremities, but was displaced into the intercondyloid notch, having been torn from its circumferential relations." This also falls under the head of *split* cartilages "the cartilage was split, so that a tongue process projected up into the joint."

Case XIV.—Mr. Penny, *Brit. Med. Journ.*, May 26, 1888, describes a case in which he produced displacement on the dead body—viz., "the internal semilunar cartilage was torn from its coronary ligaments, and was displaced into the intercondyloid notch."

Case XV.—Mr. Davies-Colley, *Brit. Med. Journ.*, p. 558, vol. i. 1888, had a case in which "the internal semilunar cartilage was split into three ribbons by two fissures running from before backwards."

Case XVI.—Mr. Morgan had a case, and presented the specimen to the Charing Cross Hospital Museum. In this "a piece of cartilage is attached by a broad base to the edge of the internal semilunar cartilage of the right knee."

Case XVII.—In the Museum of St. Bartholomew's Hospital is a specimen from the dissecting-room. Here "a considerable piece had become detached from the rim of the internal cartilage, and was standing up like a tongue, so that it could be nipped in certain movements of the knee."

Mr. Atkinson, of Leeds, has just sent me the report of two cases upon which he operated:

Case XVIII.—He found "the inner end of the internal semilunar cartilage detached from the tibia, and curled up so as to be pressed upon by

the inner condyle of the femur at every movement of the joint."

CASE XIX.—Mr. Atkinson found that "the anterior third of the internal semilunar cartilage was detached from the tibia and doubled up under the femur. It had also become firmly attached in front to the capsule of the joint, and so could not be returned to its proper position."

EXTERNAL SEMILUNAR CARTILAGES.

CASE I.—There is Sir William Ferguson's case already described (Int. Cart. case xii.), which *may* have been a displacement of the external cartilage.

CASE II.—Mr. Annandale, in the *Brit. Med. Journ*, Feb. 12, 1887, relates a case in which "the external cartilage could be seen and felt to be displaced."

CASE III.—Dr. Reid, in the *Edinb. Med. and Surg. Journ.*, vol. 42, 1834, described a specimen "in which the external semilunar cartilage had been torn away from its coronary attachments and was displaced between the spine of the tib and the posterior-crucial ligament"—*i.e.*, into intercondyloid notch.

CASE IV.—Mr. Godlee, *Path. Soc. Trans.* v page 240, showed a specimen from the dis

room "in which the external cartilage had been torn from its circumference and lay in the inter-condyloid notch. This must have occurred some time before death, as the cartilage was quite hard and stiff, and did not seem inclined to return to its normal condition."

CASE V.—Mr. Langton, in the *Path. Soc. Trans.*, 1888, page 282, mentions a case from St. Bartholomew's, of a loose body in the left knee: "the external semilunar cartilage had been torn from its posterior attachment, and was further detached laterally for half or more of its length."

CASE VI.—There is a case reported by Mr. Baird. He discovered by accident in a dead body "that the anterior segment of the external cartilage was detached from the tibia and displaced backwards and inwards. The portion was flattened and widened as if the displacement was of old standing."

From a study of these twenty-four cases I come to the conclusion that they may be placed under one of the three following heads :—

I.—The internal or external semilunar cartilages may be torn away from their—

(*a*) Anterior attachment,

(*b*) Posterior attachment,

(*c*) Coronary ligaments,

(*d*) Coronary ligaments and anterior attachment,

(*e*) Coronary ligaments and posterior attachment (rare ; Langton's case).

Thus the cartilage at its injured part is *completely* movable, and may therefore occupy some abnormal position in the joint.

II.—All or some of the attachments of the semilunar cartilages may have been stretched or *partially* ruptured, and so, although occupying their normal position with regard to the femur and the tibia, the cartilages at the same time, to a limited extent, are unduly movable, and are therefore very liable to be pinched.

III.—Split cartilages ; the cartilage being split in the middle, or separated into ribbons.

I think it better to classify the lesions in this way rather than to speak of them as complete or partial displacements, for it is very difficult to tell where the partial displacements end and the complete begin.

THE CAUSES OF THESE DISPLACEMENTS.

I now come to [illegible] of these derangements of [illegible] semilunar cartilages. [illegible]lt

it is to obtain from patients (unless they are medical men) an accurate description of the position of the tibia with regard to the femur at the moment when the displacement occurs. Lack of technical knowledge, the not being accustomed to observe the movements of their limbs, and especially the sharp pain at the moment of derangement, account for this. Nevertheless, I have looked through all the recorded cases, and shall narrate the positions and movements of the leg which the patients describe as immediately preceding these derangements. From these cases, from Dr. Scott Lang's writings on the subject, and from my own observations on the dead body, I shall try to explain the causes of the stretchings or complete ruptures of the various attachments of the cartilages.

According to the patients these varieties of internal derangements of the knee were caused by the following actions or postures :—

"Crossing one leg over the other."

"Sitting on the heels with the limbs separated."

"The knee being nearly extended and the toes suddenly turned outwards."

"Turning sharply and pushing off with the foot."

"Resting on one leg and stretching forwards."

"Severely twisting the knee."

"Catching the foot and screwing the leg suddenly and violently inwards."

"Resting on one leg and being struck on the lower part of the inner side of the same thigh."

"Kneeling for some time on the floor in the posture of sitting on the heels."

"Falling with the knee bent under" the patient.

"Slipping off a plank and wrenching the knee."

"Turning the toes very much outwards, as if standing at attention." This movement was done very suddenly.

"A small amount of violence applied to the foot at its inner side, the knees being bent to a slight degree."

"Resting on the feet with both hips and knee-joints strongly bent." Pain was felt on the outer side of the joint.

Dr. Knott, in the *Dublin Quarterly Review*, 1882, p. 489, thus refers to the causes of derangements of his own knee: "It has always been the result of a *very slight* and, in every instance, an *indirect violence*. This violence has always been applied so as to produce a twist of the knee, either of the leg outwards or of the femur inwards. The most common cause has been striking the inside of the great toe against something when the knee has been slightly flexed, the parts about the joint as

relaxed as possible, and the muscles thrown off their guard. I never suffered any derangement when the limb was in a decided state of active movement."

These individual records will show the great variety of actions, and of positions of the joint, which may occasion these derangements. The cases could have been considerably added to, but those that I have not related fall under one or other of the above descriptions.

A fitting summary of the causes of these lesions is to be found in the writings of Dr. Scott Lang. As his account is an excellent one, and agrees with the results of my own experiments, I cannot do better than quote it here; though it will be understood that the causes naturally enough vary somewhat in different cases.

The *internal* semilunar cartilage is displaced in *rotation of the leg outwards* combined with flexion; the *external* semilunar cartilage, in *rotation of the leg inwards* combined with flexion. Here is the explanation:—

When rotation *outwards* takes place, the gap between the internal condyle of the femur and the head of the tibia will be found to be increased; and the internal semilunar cartilage is movable, and consequently is apt to slip too far in between

the condyle of the femur and the corresponding head of the tibia.

A parallel state of affairs results when the tibia is rotated *inwards*, for then the gap between the external femoral condyle and the head of the tibia is increased, and thus the external cartilage is more movable.

When the knee is flexed, the anterior part of the internal semilunar cartilage glides backwards on the head of the tibia; if the leg be then rotated outwards, the internal semilunar cartilage will be drawn in between the internal condyle of the femur and the head of the tibia. A sudden movement of extension will then cause the internal condyle to roll on to too much of the internal semilunar cartilage. Now, as extension is always combined with external rotation of the tibia, the inner tuberosities of the latter must make a sweeping movement forwards and outwards. The internal cartilage will be held by the femoral condyle, and as the tibia makes its curve forwards and outwards the coronary ligaments will be stretched, or even torn. This, doubtless, is what occurs in aggravated cases, and when the accident has recurred frequently. The converse applies to displacements of the external semilunar cartilage. In the milder forms

there may be only a stretching and relaxed condition of the coronary ligaments, but when once thus relaxed they are always in danger of being further stretched, or even ruptured.

There are some conditions which predispose to these derangements.

A lax condition of the ligaments about the joint, caused by general debility or previous synovitis, predisposes to these accidents on account of the insecure way in which the femur and tibia are then bound together. Prolonged flexion of the knee-joint, as in kneeling, strains the anterior part of the coronary ligaments, and renders possible a liability to these disorders.

To sum up the main causes:

1. *Flexion*, or *semi-flexion*, is necessary, for it is in this position only that any amount of rotation inwards or outwards can be produced, and that the ligaments about the knee are then relaxed.

2. The injury is caused by some *sudden* and almost *involuntary* movement. Most of the muscles governing the joint are then thrown off their guard, or fail to act in concert one with the other.

3. Derangement may result from some *trivial* accident (when the joint is in a fit position),

so that at first the ligamentary attachments are only stretched. But unless properly treated, this may be followed by permanent lameness, for the cartilages, being too movable, are likely to be caught, and thus their attachments are liable to further or even complete rupture.

4. Displacements may be caused by any *violent* accident.

GENERAL SYMPTOMS AND DIAGNOSIS.

I will now relate the symptoms of these derangements of the semilunar cartilages, and hope to show that, from a study of these symptoms, combined with a careful examination of the injured joint, a more or less definite diagnosis may be arrived at in the majority of instances.

The symptoms may be manifested both in *acute* cases—*i.e.*, cases in which the accident has just occurred for the first time—and in *chronic* cases, when the accident is of frequent recurrence, and the derangement is liable to return at any moment. In this latter, or *chronic stage*, the symptoms are most marked (for constant repetition of the injury has tended to confirm the disorder), and are better observable on examination.

[illegible] usual absence of the

severe pain which is experienced on the first lesion.

Patients usually present one or more of the following symptoms :

Directly after the cartilage is displaced there is often tenderness over the upper part of the tibia.

Flexion is not interfered with, and its exercise gives rise to no pain.

The knee is fixed in a semi-flexed position.

There is inability to completely extend the limb.

An attempt at forcible extension will probably cause pain over the tuberosities of the tibia—over the inner head, if the internal cartilage, over the outer head, if the external cartilage be affected.

On extension a prominence will be produced, or a depression be felt, between the femur and tibia on the inner or outer side of the ligamentum patellæ.

Forced extension may cause acute pain, the sensation being as if something was jammed between the femur and tibia.

Patients sometimes compare the joint to a hampered lock, or to a gate with a stone in the hinge. Such a joint will move freely in one direction (flexion), but after having reached a particular point in the other direction (extension) its motion will be suddenly arrested.

If, on examination, the knee is bent to its utmost, a crack or click may be heard, and the depression or elevation on the inner or outer side of the joint may altogether disappear. This is due to the displaced cartilage, or portion of cartilage, slipping back into its normal position.

On rising suddenly from a kneeling posture severe pain may be felt in the knee, and the patient be unable to straighten the limb. The same occurs when rising after a fall.

When the accident has frequently occurred, the knee gives way on walking, and great pain is suffered.

Patients can generally walk on the injured leg, but with an obvious limp.

Such a movement as walking upstairs may cause the leg to slip and become fixed.

Running is sometimes possible, but then only in a very awkward manner, for fear of the joint becoming fixed.

The foot is generally turned *inwards* if the external cartilage be affected, and *outwards* when the internal cartilage is deranged.

There is usually little or nothing abnormal to be seen about the joint—*i.e.*, no swelling or alteration in shape is visible.

The above are the general symptoms common

to all varieties of displacement of the cartilages, but they may be modified according to the particular manner in which the accident has been produced.

Again, a derangement caused by a recent accident does not always exhibit all the symptoms present in joints, where the injury is of old standing, and the displacement is of frequent occurrence.

It is wise to note that synovitis often supervenes in a few hours after the accident, and, unless a *prior* examination has been made, may mask the symptoms of the particular derangement.

SYMPTOMS AND DIAGNOSIS OF EACH VARIETY OF DISPLACEMENT.

We now turn to some of the symptoms peculiar to each particular injury, and to the method of obtaining a satisfactory diagnosis. Like the more general symptoms, these special symptoms are more observable in *chronic* than in *acute* cases, both from the displacements being more clearly marked, and from the greater facilities for examination. In acute cases, indeed, the surgeon's main object

is to reduce the displacement, and relieve his patient as quickly as possible.

For the diagnosis of these disorders it is most advisable always to ocularly compare the sound with the affected knee, and likewise to make use of both hands, placing one on the healthy and the other on the injured joint. The semilunar cartilages are so small that this procedure is necessary to detect the slightest amount of displacement or the minutest loss of similarity.

Cases in which the cartilage at its injured part is completely movable, and may therefore occupy some abnormal position in the joint. (*Refer to pages* 22 *and* 23.)

If the *anterior* portion of the cartilage be torn away, there may be an *absence* of the cartilage (as compared with the sound side) about the front of the joint, and when the leg is extended upon the thigh an interval may be felt.

At other times the cartilage at its anterior attachment may be slipped by the finger upwards over the femur, and even downwards over the head of the tibia. I have seen the cartilage to be so displaced as to be turned upwards, its anterior extremity resting on the lower end of the femur,

midway between the anterior and posterior portions of the joint.

All the coronary ligaments may be ruptured and the cartilage situated in the intercondyloid notch. (*Pages 22 and 23.*)

Then, together with some of the symptoms common to all varieties of displacement, no semilunar cartilage can be felt, even after a careful examination with the leg flexed or extended. The point that diagnoses a displacement of the cartilage in this case is that, if the leg, when semiflexed, is everted on the thigh, an increased interval may be felt between the tibia and femur on the outer or inner side of the joint.

Cases in which all or some of the attachments of the cartilage may have been stretched or partially ruptured, and so, although occupying their normal position with regard to the femur and tibia, the cartilages are at the same time, to a limited extent, unduly movable, and therefore very liable to be pinched. (*Page 23.*)

Here the diagnosis is, that the fingers feel there is too free movement, the cartilage (as compared with the sound side) being pushed *too far out of*

the joint when the leg is extended, and *too far into* the joint when the leg is flexed on the thigh.

Split cartilages, the cartilage being split in the middle, or separated into ribbons. (*Page* 23.)

I know of no way in which a split cartilage can be distinguished from a detached one, except when one of the pieces is turned outwards, and may then be felt. However, even if it can be felt, it is difficult to diagnose from a displacement of the entire cartilage.

The above-described means of diagnosis may be applied both to the external and to the internal cartilages. Knees surrounded by an excess of adipose tissue may present some difficulty to the surgeon, but this may be overcome by a careful study of the nature of the accident and the symptoms of the derangement, and by a diligent comparison of the sound with the injured joint.

In some cases, many or most of these signs of derangement may be absent ; it is, therefore, to trivial accidents that particular attention should be paid. For, if trivial accidents are not carefully seen to, the resulting derangements may prove to be of a serious nature, and cause pain and dis-

tress and a long period of convalescence. Nay, the joint may be thrown into such a condition as to be afterwards liable to further accidents, and repeated attacks of internal derangements. If these become chronic, an operation may be the only means of cure. On the other hand, by a correct diagnosis, and a prompt treatment of the displacement, the patient may, by the aid of sufficient rest, be spared the worry of an insecure joint.

CHAPTER II.

TREATMENT OF THE DERANGEMENTS OF THE SEMILUNAR CARTILAGES.

For the sake of convenience I shall treat the displacements of the cartilages under the two headings already referred to; first, *acute* displacements when the derangement occurs for the first time, or when some considerable period has elapsed since the preceding accident, and the previous injury has become quite healed, or perhaps, even, almost forgotten.

Under the heading of *chronic* fall all those cases in which the derangement takes place very frequently, on the slightest provocation, and practically renders the patient an invalid as far as the knee is concerned.

In *acute* cases the first point to be considered is the method of reducing the displaced cartilages. The patient's leg may be fixed in one of the positions already described. Having found that there is no fracture of the bones composing

the knee-joint, the surgeon should set the patient on a high chair or on a table (the latter is preferable), and subject him to, or allow him to try, one of the following movements. If one fails, some or all of the others should be gone through :—

1. Flex the leg as much as possible on the thigh, drawing upon the tibia as if to separate its articular surface from the femur. Then rotate the tibia, inwards if the internal cartilage be displaced, outwards if the external cartilage be affected. Both movements should be resorted to if the usual one does not succeed. Then extend the leg on the thigh, quickly but not with any great violence, at the same time pressing with the thumb upon any projecting cartilage.

2. If an external cartilage is displaced, reduction has been effected by flexing the leg on the thigh, moving the leg from side to side like a pendulum, then rotating the leg firmly outwards, and finally suddenly extending it.

3. A patient of Sir Astley Cooper's used to reduce an external displacement by sitting on the ground, bending the thigh inwards, and pulling the foot outwards.

4. A patient of Sir William Ferguson's was accustomed to reduce an external cartilage by pointing the toe outwards, and then lifting the leg

forwards, with the other foot behind the tendo achillis.

5. Hey reduced one cartilage twice and another once (he does not say whether they were external or internal) by first extending the limb, and then suddenly moving it into extreme flexion.

6. The internal cartilage has been replaced by pressing upon it, and at the same time slightly flexing the joint.

7. The method Mr. Holmes employed was to instruct his assistant to place his arm in the popliteal space, to serve as a fulcrum. The leg was then drawn downwards as far as possible and slightly rotated, any projection being at the same time pressed on.

8. Smith, of Leeds, reduced many displacements by first making a few feints at flexion, and then, when the patient was off his guard, performing complete extension.

The first method is the most scientific, for we know that these displacements are usually produced by certain movements peculiar to each cartilage. Therefore, if these movements are repeated, but in reverse order, the cartilages may be easily replaced.

The return of cartilage to its normal position is often signalised by an audible click.

If the patient be very nervous, or if an attempt at reduction has failed, an anæsthetic should be administered; then the nature of the derangement can be more easily discovered, and the muscles being relaxed, which were thrown into spasm by the accident, the displacement can be more readily reduced.

When the displacement has been remedied, and the joint can be moved with ease and without pain, the leg should be placed on a back-splint reaching from foot to thigh, and evenly secured to the splint by a bandage, the knee being left exposed. If much effusion and pain follow on the injury, some patients obtain relief from the application of an ice-bag; others are more benefited by a Martin's bandage, evenly and fairly firmly placed over the distended joint.

As soon as the effusion has subsided, or in a few days if there has been no effusion, the leg may be taken off the splint and fixed by a plaster of Paris bandage, or some other apparatus of that nature. This must extend from the foot (including the foot) up to the gluteal fold, so as to permit of no flexion or extension of the knee. The fact of the foot being included in the same splint with the leg prevents the tibia from being rotated on the femur;

did the apparatus extend only from thigh to ankle this rotation might take place, and thus the cartilage would not be kept absolutely at rest.

In my opinion this splint should be worn for at least six weeks ; by this means, if at the accident the cartilage was torn from its attachments, these ruptured attachments may be enabled to heal, the cartilage become refixed, and future derangements be prevented. On the other hand, although the displaced cartilage may have been reduced by manipulation, yet as its attachments have been torn through or stretched, unless the above details are rigidly adhered to—viz., the keeping of the knee absolutely at rest as regards not only flexion and extension, but also rotation—in a few days a new accident may occur. If this is repeated three or four times, a trivial stretching may become permanent, or end in complete rupture of the attachment. Such a state, in my opinion, is only to be cured by one of the operations to be described in the treatment of the chronic variety.

It will thus be seen how important it is for the practitioner, who attends the first accident and affects the reduction of the cartilage, to follow up this by giving the joint a period of complete rest, so that the stretched or torn attachment may become soundly healed.

I am convinced that were this line of treatment systematically pursued from the very first, we should see but few instances of chronic displacement, and an operation to effect a permanent cure would only be necessary in a very limited number of cases.

In about six weeks the plaster of Paris splint should be taken off and movement of the joint permitted; but in most cases it is wise for patients to wear some form of knee-cap. Soon these may be dispensed with, for in the majority of cases the ruptured structures will have healed, and there will be no likelihood of any further displacement.

According to Dr. Scott Lang, however, it is wise for those who have suffered from displaced internal semilunar cartilages to learn to walk with the foot turned outwards to prevent any slipping, or to walk with the foot turned inwards if the external cartilage has been affected.

TREATMENT IN CHRONIC CASES.

This question of the treatment of chronic forms of displacement is exceedingly important, and it is only within the last few years that it has been studied with energy and that operations have been resorted to.

In these chronic cases the constant slipping in the joint and the frequent pain prevent the patient from entering into any active sport, and even incapacitate him from performing his daily duties. This state of things may be caused, not only by the neglect of rigid treatment at the first accident, which I have alluded to, but also by the severity of the injury, which allows of no possible cure by means of perfect rest, splints, and so forth.

In most of these cases I strongly recommend an operation to effect a permanent cure, and especially do I advise this for all young patients. It is altogether pitiable for the young to have to go through life practically disabled from indulging in any healthy and invigorating sport or pastime, and at times even inhibited from taking any active exercise whatever. In these days of advanced surgery it is absurd for the young to be subjected to the constant wearing of splints and other apparatus, not to mention the discomfort caused, or the limitation of the movements of the joint, which constitutes the chief or part object of all these varieties of splints.

In the aged, however, who do not take or are not obliged to take so much exercise, I do not so strongly advise operative procedure, for they

may be content to bear some amount of discomfort.

There are some points to be observed before dealing with a chronic lesion of the internal semilunar cartilage. It is not wise to operate when there is any synovitis. The patient should be put to bed till it has subsided. In all cases, indeed, I think it better for a patient to spend a few days in bed prior to the operation, so that he may become, as it were, acclimatised to the surroundings.

The splints to fix the leg after the operation had better be made of wood. There should be a back-splint with a foot-piece, to extend from the foot to the gluteal fold, carefully padded and covered for its entire length with mackintosh. A long outside splint is also required, which should extend from the foot up to the axilla, and an internal splint to reach from the foot to the perineal fold. All these must be constructed to fit the patient comfortably.

The instruments required for the operation are a scalpel, a pair of short straight scissors, about six clips, and two Liston's artery forceps; some straight and one or two curved needles, a blunt hook, and a pair of small retractors; about a dozen silkworm gut sutures, which have been rendered flexible by being soaked in hot water

for three hours, and some well-carbolised catgut sutures (No. 4 size); a dissecting forceps, a curved needle on a handle, and drainage-tubes of various sizes. All these must be absolutely clean, and have been placed in carbolic acid lotion (1 in 40). Six perfectly new sponges are also requisite.

The knee should have been well cleansed with soap and water, and surrounded for some time with gauze soaked in carbolic lotion (1 in 20).

The patient being anæsthetised, and the leg bent at a right angle with the thigh, I make an incision about two or even three inches in length, commencing (if it is an *internal* cartilage that is to be dealt with) in the parallel axis of the leg, and on a level with the middle of the patella, and extending it downwards to about an inch below the head of the tibia. This incision should be three-quarters of an inch from the border of the patella.

All the bleeding points being clipped, I then divide the capsule, taking care to cut all the deeper structures to the same length as the skin incision.

We now reach a certain amount of fat (varying in individual knees) between the capsule and the synovial membrane. As soon as this is divided, the synovial membrane may be opened; this may

be done by picking it up (which may be facilitated by straightening the limb), or by pushing a knife through it. I now clip both sides of the synovial membrane with a Liston's forceps so as to command it—as is done with the peritoneum in abdominal surgery—and then with scissors divide it to nearly the same extent as the skin incision, but not quite to the same extent, leaving at each end about half an inch undivided.

The reason for this latter procedure is that it is sometimes difficult at the angles of the wound to pass the needles when sewing up the synovial membrane ; hence an interval might be left, through which material from the skin-wound might drain into the joint.

The next point is to pass the finger into the joint and examine the position of the cartilage, the blunt hook being placed under its margin to test its mobility. If it be in place or displaced, if its anterior attachment has been torn away or is loose, whether any portion of it is split—all these questions are to be determined. For the testing of these states it is advisable to flex and to extend the limb, the flexed position being the better for obtaining a good view of the joint, but the extended posture being often preferable for manipulating.

Here we arrive at the procedure necessary in the various conditions of the cartilage.

(1) If the anterior attachment is torn away, and the cartilage is displaced either into the intercondyloid notch or outwards.

(2) If all the coronary ligaments have been torn away, and the cartilage is curled up and situated in the intercondyloid notch, being evidently permanently crumpled and not easily uncurled.

(3) If the cartilage is split in the middle, or fissured into ribbons.

In these three conditions I think that the following treatment is necessary :—

I draw the cartilage down with the hook ; then, holding on to the cartilage with the clip forceps, I pull it into the wound—in fact, render it quite taut upon its posterior attachment. Next, with the other finger, I examine its attachments as far back as possible, and pull the cartilage upwards towards the thigh. While the assistant holds it tensely in that direction, I pass one finger along the cartilage as far towards its posterior part as I can, glide my scissors along the finger on the cartilage's under-surface, and cut it away as near the posterior attachment as I find to be practicable.

In condition (2) although the coronary liga-

ments may have been torn away, and the cartilage be curled up, yet if it can be pulled down and released from this curled condition, it may be treated in the same manner as the two following derangements :—

(1) Stretching of the coronary ligaments, and hence too free movement of the cartilage ;

(2) Rupture of the coronary ligaments, and hence too free movement ; but the cartilage only slipping, and *not* curled up into the intercondyloid notch.

In these conditions the cartilage must be drawn towards the wound, and firmly held there, either by the hook, or by the finger. A curved needle, mounted on a handle, should now be passed, first through the fibrous tissue about the head of the tibia, commencing half an inch below its upper surface, and then through the cartilage. The needle should then be armed with a catgut suture, and after being armed should be withdrawn. With the cartilage still held in position, the catgut should be tied up tightly, and in the first part of the tie two turns should be made, so that, when the second portion of the knot is being made, the catgut cannot slip. If the cartilage is not thought to have been sufficiently secured by this, a second, or even a third ligature

should be introduced, and used in the same manner.

All the bleeding being arrested, the suturing can be commenced. As the Liston forceps are holding the synovial membrane, the latter is easily found. I now pass the needle threaded with the silkworm gut through the skin on one side, and pick up the synovial membrane on the same side ; then the needle is passed through the synovial membrane on the other side of the wound, and afterwards through the skin. Hereupon the ends which have thus been passed through the tissues are handed to the assistant. Six or more sutures are treated in this manner, an interval of a quarter of an inch being left between each. Great care should be taken to pick up both edges of the synovial membrane in each stitch.

I next thoroughly irrigate with carbolic lotion (1 in 40) until the fluid pours out in quite a clear state—in fact, till all the blood has been washed out of the joint. A small drainage-tube is then inserted just below the last suture, and each stitch is carefully tied up.

The leg should now be placed on the splint, and carbolised gauze be applied all over the front of the knee. This is to be surrounded by a sufficient [illegible] of carbolised wool and antiseptic dressing

put all round the splint and knee. This dressing should extend from the ankle well up the thigh, and the whole leg and splint be carefully and equally bandaged, so that firm pressure may be exerted from the foot to the top of the thigh.

The *after-treatment* is very simple. First of all the foot is raised; should there be much pain the application of an ice-bag to the knee may afford relief.

During the earliest stages I have the temperature taken every four hours, and if it rises to 102° I re-dress the limb. On the day but one after the operation (as a rule), unless there has been some previous indication of its necessity, I remove the dressings, and take out the drainage-tube, which by that time has generally done its work. Antiseptics are then re-applied. After the lapse of two more days temperature need only be taken night and morning.

From now the limb rarely requires dressing until ten days have passed, and then in most cases the wound will be found to be perfectly healed. All the stitches may then be removed, and strapping plaster is applied to prevent the wound breaking open again.

Two or three weeks after the operation, the leg may be taken off the splint, and the patient

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should be recommended to use it in bed. At first he is generally nervous about moving it too much, but in two or three days he loses this dread. He should now be advised to get up and use the knee as much as possible.

As the knee is generally somewhat stiff, the joint should undergo massage daily, and slight passive movement should be employed. To render the joint perfectly movable, it is wise for the patient to go through the exercise of trying to sit on his heels; after a little while the joint will become quite free.

The same details must be used in the treatment of derangements of the external cartilage, but the incision should be begun on the *outer side* of the patella, about three-quarters of an inch from its border. It should be three inches in length, and extend to an inch below the head of the tibia.

As when dealing with the internal cartilage, removal should be employed—

(1) When the cartilage is completely detached from the tibia at its circumferential attachments, and is turned up into the intercondyloid notch;

(2) When the cartilage is ruptured at its [illegible] nent, and is thus freely

Suturing should be used when the cartilage is too freely movable, and becomes constantly nipped, but does not suffer complete displacement.

FIG. 1.

I shall now endeavour to prove from anatomical facts that the knee-joint had better be opened by a vertical incision rather than by a transverse one. In order to make my reasons clear we must enter upon a brief study of the structures which cover the front of the knee-joint.

As shown in Fig. 1, there is first, skin (*a*); then the cellular tissue (*b*), which varies in amount according to the fatness of the knee; next, the capsule of the joint (*c*). After these

—for about 1½ inches above the head of the tibia on the outer and the inner side—is a mass of fat (*d*), but this fat is altogether wanting on a level with the patella. Finally, we have the synovial membrane (*f*).

Now these facts are of great importance to the operator.

When cutting down on the joint, it is always advisable to open it first at its upper part on a level with the middle of the patella (*g*). Then when an incision has been made in the synovial membrane, scissors should be introduced, and the rest of the capsule opened by them. If an attempt is made to first open the joint at its lower part, great trouble is experienced in digging through the fat at *d* before the synovial membrane is reached. Indeed, when a transverse incision is employed, fat has to be worked through the whole time.

I have other reasons for choosing a vertical incision and for making it three-fourths of an inch from the patella.

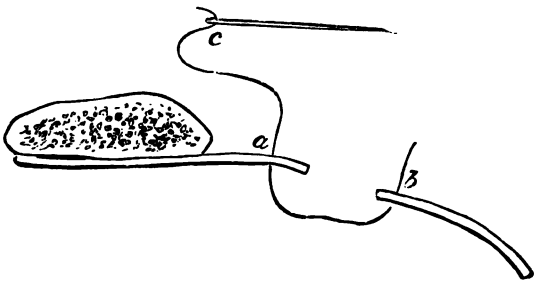
When this incision is used, no muscular tissue is to be met with about the joint, for at this point the vasti are represented only by tendon; moreover, the joint is less weakened when opened in the direction of its muscular or, rather, tendinous

supports than it is when they are divided transversely.

The vertical has another advantage over the transverse incision, in that it enables the surgeon to obtain a better view of the interior of the joint.

Again, if the vertical incision is made three-fourths of an inch from the patella, it will be seen

FIG. 2.



from the adjoining diagram (Fig. 2) that there is enough synovial membrane at *a* to unite with the other side of the cut synovial membrane at *b*. This portion of the membrane can thus be easily

FIG. 3.

picked up and included in the sutures (*c*). On the other hand, if, as in the next diagram

(Fig. 3), the incision has been made too near to the patella, the synovial membrane, in consequence of being adherent to the patella, is not slack enough, and cannot be picked up.

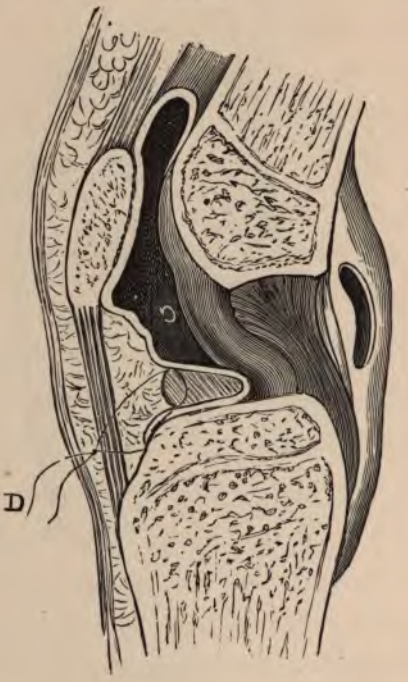
There is another reason why the vertical incision is superior to the transverse cut used by some. Because the synovial membrane is reflected off the

FIG. 4.

capsule of the joint, first over the semilunar cartilage, then around its thin edge, and so back over its under surface, finally becoming lost and adherent to the head of the tibia; when a transverse cut has been employed, the lower cut edge of

the synovial membrane (*a* in Fig. 4) is not sufficiently mobile and is too short to be carefully included in the suture and united with the upper cut portion (*b*). Furthermore, when a vertical incision is used, the semilunar cartilage can, practically, be sutured extra-synovially (as at *d* in Fig. 5); for the synovial membrane is

FIG. 5.



reflected around the semilunar cartilage, and the greater portion of the knotting and tying is made outside the cavity of the joint.

As in future chapters the importance of the details necessary in opening a knee-joint will not be so fully dealt with, and as reference will be made back to this chapter, I think this is the place to explain why (if due care be taken) no great danger need be feared on opening the knee-joint, either as an exploratory measure or as a definite operation.

Sir Spencer Wells has shown that incisions into the abdomen cause practically no danger, if only the suturing has been properly attended to. In my opinion the same holds good with the knee-joint.

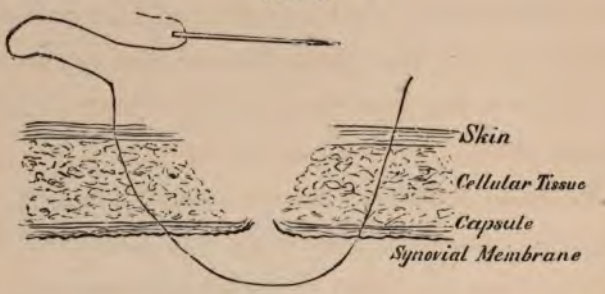
The two succeeding diagrams will render it easy to see that unless the suturing is conducted with a definite object—that is to say, with a determination to bring the two synovial edges well together, patients are likely to incur destruction of the joint if there be any suppuration about the wound. Even if there is no suppuration, lymph or blood may drain down from the cut into the joint.

Fig. 6 shows what I do in these cases—viz., bring the synovial edges together by means of the sutures.

The result is that probably in twelve hours the synovial edges will be firmly glued together, and lymph or pus that may form will be most

likely to find its way out through the skin, and, in any case, will not be able to merely drop (drain) down into the joint.

FIG. 6.

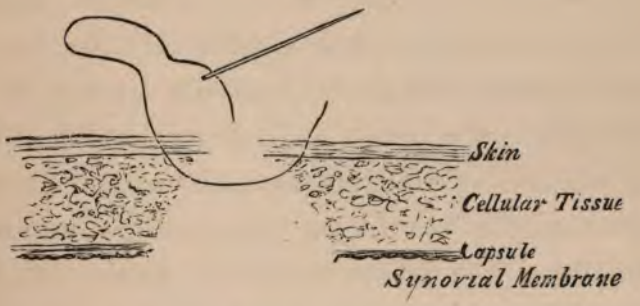


This is well illustrated in one of the cases related in the chapter on the Ligamenta Alaria. In this case there was a little cellulitis about the wound, which led to slight suppuration; yet there was not the least amount of fluid in the joint, precisely because I had taken such great care to bring the serous edges together that they had firmly united and safely shut off the joint.

Fig. 7 represents the usual way in which wounds or purposely made incisions are sutured. Then suppuration or destruction of the joint is very likely to occur; and if the patient escapes such a condition, he has to thank some happy luck rather than any particular skill on the part of the surgeon. Here are my reasons for this statement.

As the suture has been put only through the skin, and no attempt has been made to bring the synovial membrane together, any lymph or pus that is formed must and does drain into the joint; for it should be remembered that tissues retract when cut, and the synovial membrane retracts to a very considerable extent. The result is, that unless the synovial edges are brought together, a **V** is made which is turned upside down, **Λ** (see Fig. 7), and hence drainage into the joint may occur; whereas, when the synovial membrane has

FIG. 7.



been firmly joined together by the suture (see Fig. 6), there is no **V**, or if there is one it is turned the right way up (**V**), and thus there is no possibility of pus falling into the joint.

With regard to the use of drainage-tubes, a study of my cases has led me to the following conclusions; wh[illegible] removed, I think

it well to employ drainage; when a cartilage is only fixed, the use of a tube is not necessary. In fact, I go on the same principles as are followed in abdominal surgery: when the case is emphatically a "dirty" one—that is to say, when much blood has got into the joint, or much fingering has been requisite—I use drainage; on the other hand, if the case is a clean one, in which little has been done, and there has not been much disturbance of the joint, I do not drain.

All kinds of drainage tubes have been used, but what I consider the best is a small indiarubber tube inserted well into the joint. This should remain in for not more than forty-eight hours—that is to say, until the risks of sharp effusion have passed off. In two of my cases in which no tube was used, and effusion occurred, causing some pain, I introduced a probe into the joint between the sutures, and allowed the fluid to run out by the side of the probe. This is generally quite sufficient to stop the pain, and, moreover, leaves a small hole by which synovia may ooze out, should it chance to re-accumulate.

Upon all the above details, which are of extreme importance, depends in great measure the success or the failure of these operations on the knee-joint. Most of the failures recorded, many of the

dangers feared, arose from neglect of such precautions. If simple wounds of the knee-joint caused by accident are in future enlarged and treated in the manner advocated above, I think that in these cases amputations will rarely be necessary, and stiff knees will seldom result.

CHAPTER III.

CASES IN WHICH THE SEMILUNAR CARTILAGES HAVE BEEN OPERATED UPON.

As the recorded cases of cure *by operation* of these internal derangements are few in number, I think it may be interesting and useful to detail them in the words of the operators who have published them.

First, I have grouped together the cases in which the cartilages, or portions of them, have been removed.

Case I.—Mr. Brodhurst (in *St. George's Hospital Reports* for 1867, vol. ii., pages 142, 143) relates a case in which "a clergyman, aged 25, whilst playing football early in November 1866, struck the ball on to a hill-side, and again hastily kicking, he missed the ball. By the force of the blow he was swung round, and fell to the ground. He immediately arose, and attempted again to kick the ball, but could not. He was forthwith unable to walk. Considerable pain supervened in the joint,

with swelling, so that when surgical aid was obtained the displacement which had occurred at the time of the accident could not be distinguished. After six weeks the swelling had entirely subsided, but he could not walk. The pressure of the foot on the ground caused considerable pain, and progress was at this time impossible except with the aid of two sticks. In this manner he walked into my house when I first saw him, six weeks after the accident.

"On examination, the left knee presented a loose cartilage lying on its inner side, somewhat obliquely, immediately in front of the internal lateral ligament. There was neither effusion into the joint nor thickening of the synovial membrane. The pain caused by the presence of the loose body rendered active treatment necessary; and the case being admirably adapted to the removal of the cartilage, the operation was explained, and at once assented to: it was performed on the same afternoon.

"An incision was made about three-fourths of an inch below the cartilage with a small tenotome, local anæsthesia being employed. The knife was carried up freely to the cartilage, and a sufficiently wide passage was made for the body easily to move along; but it could not be moved. It was easily

seized, but it was evidently adherent, and could not be brought away subcutaneously. I therefore cut down upon the body directly, and found it somewhat different from what I expected to find, and detained *in situ* by a small band of ligament. This band was touched with the point of the knife, and the cartilage forthwith came away. There was no escape of synovia from the joint. The limb was carefully bandaged. Little or no pain followed the operation. The bandage was not removed for seven days. At the expiration of this time it was removed, and the wound was perfectly healed. In fourteen days after the operation my patient walked firmly, without lameness and without a stick, and was ready to skate, or for any other exercise; but he abjured football.

"The body which was removed was three-fourths of an inch in length, soft, smooth, and pliable, and there were attached to it some ligamentous fibres. It was the anterior portion of the internal semilunar cartilage, and retained in every respect its normal appearance. The specimen is preserved in the museum of St. George's Hospital."

CASE II.—In the *Clinical Society's Reports* for 1889 I have recorded the following case:

Mr. W., aged 20 (sent to me by Dr. Wharton Hood), stated that in October 1887 he

was playing Rugby football, and was running with the ball. Being collared, he came to the ground, and found himself sitting with his legs crossed, in a not uncomfortable posture. Springing up, he was surprised to find that he had to limp, for his fall had been by no means a violent one. His right knee slightly pained him on the inside, but he continued playing, and the pain soon ceased. That evening he observed that the knee was swollen and puffy. Next day he played again, with no evil effects at the time, though the side of the knee felt a little strange. He consulted a doctor, who painted the knee with iodine, and in a few days the effusion ceased.

He soon began to play again with his knee bandaged, but now he noticed that any exceptional exertion produced the sensation of his leg being broken at the knee, the upper part being pushed inwards and the calf outwards. Generally the pain was only momentary. Presently every slight stumble reproduced the above-described pain, followed by effusion in the joint. The doctor continued the painting with iodine, the cause of the pain being, in his opinion, a straining of the internal lateral ligaments.

Ever since that time his leg had been a source of constant trouble. The slamming of a door, the

springing from a low hedge, any little stumbling, a sudden turn, a jumping into bed, anything that occasioned any *uncertain* movement of the knee, caused swelling of the joint and the old pain. Yet in the intervals between these *contretemps* he could freely walk or run. A game at fives, even though he wore a knee-cap, was more likely to prove disastrous than a lengthy cross-country run, and a *slipping* for a few inches more fatal than a jump for a good many feet.

In the summer of 1888 he hurt his knee while playing at cricket, and for the first time had to rest the leg, the effusion being worse than usual. In August 1888 he was fielding and stooping to pick up a ball when he felt a "crunch." From that time his trouble from the knee was constant, his finger sometimes detecting a loose body. Such is the patient's account of his case.

When I first saw him, on September 1st, 1888, I found the right knee in the following condition: on the inner side of the knee, in the interval between the femur and the tibia, rather more towards the back than the front of the joint, was a hard, fairly movable, body about 1½ inch in length. This appeared to be fixed at its lower and posterior part, but the anterior could be made

to move slightly forwards and backwards. Upon the patient flexing the joint there seemed to be an abnormally large interval in the front part on the inner side of the patella; no internal semilunar cartilage could be felt. There was then no effusion in the joint, and gentle movement did not excite pain. In my own mind I thought that the internal semilunar cartilage had been torn away from its anterior attachment, but I was not certain whether it might not be a case of a pedunculated loose cartilage.

I explained to the patient the supposed dangers of opening the knee-joint, but these he readily consented to incur, the knee in its present condition being practically useless to him and a source of constant trouble.

On Sept. 5th, assisted by my friend, Mr. Cotes (Dr. Wharton Hood, much to my regret, being unavoidably absent), I opened the knee-joint, practising strict cleanliness, but using no spray. An anterio-posterior incision was made, two inches in length, its centre being over the cartilage and corresponding to the interval between the femur and tibia. Before opening the synovial membrane I carefully secured all the bleeding points. Upon the joint being opened and the edges of the synovial membrane clipped so as to

prevent it slipping into the joint, a small amount of synovial fluid escaped. I then saw that it was the internal semilunar cartilage with which I had to deal. I caught hold of this and attempted to drag it out of the joint, for it had plainly been torn away from its anterior attachment, and was resting upon the inner side of the internal condyle of the femur. I could not pull it out, for it was firmly fixed at its posterior part. Accordingly I passed scissors into the joint and cut off the cartilage as near to its posterior

FIG. 8.

attachment as possible. The piece of cartilage removed is exactly depicted in size and form by Fig. 8. The joint was then thoroughly syringed out with carbolic acid (1 in 40) until the lotion flowed out of the wound unstained with blood. I next passed six catgut sutures through the synovial membrane, tying them up tightly so as to approximate the cut synovial edges. After this silver sutures were used to unite the skin. The leg was now dressed with carbolised gauze and salicylic wool and antiseptics employed. No

drainage-tube was used. The whole leg was placed upon a back-splint, extending from the gluteal fold to the foot, and was carefully bandaged, a long outside splint being also used.

On visiting him four hours afterwards he had vomited, but there was no pain. Temperature, 98°. Later in the evening still no pain, but temperature had risen to 99°.

Sept. 6th.—Fair night. Temperature, taken every four hours, had reached at 4 P.M. 100.2°. There was no pain or tenderness in the knee, and no discharge through the dressing.

Sept. 7th.—Temperature, 100°; pain in knee all night, and consequently no sleep. The bowels had not acted, and the tongue was dirty. I removed the dressings and found that the joint was distended with fluid and was tender, but there was no œdema. On the removal of the dressings a synovial fluid issued from the wound. I therefore took out one of the silver sutures so as to allow free discharge. Antiseptics were re-applied and an ice-bag placed over the dressings. A purgative was given. At 6 A.M. the temperature had fallen to 99.8°, and there was no pain in the knee. From this time the temperature never rose higher, varying for some days between the normal and 99.6°.

Sept. 8th.—Fair night, no pain, a little tenderness on pressure, general condition much better; temperature, 99°.

Sept. 9th.—Wound re-dressed and looking well, though still discharging synovia. Temperature normal; no pain, still a little tenderness to touch. Antiseptics reapplied and ice continued.

Sept. 10th.—Temperature up to 99.6° during night, but returned to normal in morning. Some weight and pain in knee of a heavy character. Bowels had acted; had slept fairly well.

Sept. 11th.—Wound re-dressed; all stitches removed, except one in the centre of the wound, which was not now discharging synovia, though the joint was still full of fluid, but not tense. There was a little tenderness to touch, but no œdema.

Sept. 12th.—Knee fairly comfortable. From this date the patient went on very well, the distension gradually diminishing, and there being no pain or tenderness.

Sept. 22nd.—Antiseptics were left off. The wound had all healed except for a little spot at the posterior part, which had broken down superficially. It was then dressed with zinc ointment, the splints being still continued.

Sept. 26th.—Wound all healed; still a little

effusion, but no pain about the knee. The leg was taken off the splints, and the patient was told to use it a little, though remaining in bed. The joint was rather stiff, and he was able to flex it only very slightly.

Sept. 28th.—Patient got up and was allowed to walk about the room. There was no pain in the knee, and he could easily stand upon the foot; but the leg was still stiff, and he could not flex it completely on the thigh, complaining of a "dragging" and a sense of tightness under the patella.

Sept. 29th.—After using the leg all that day, although there was no pain in walking, yet the joint became slightly swollen; I therefore ordered him to wear an elastic knee-cap.

Oct. 3rd.—He went home, there being very little effusion. He could almost completely flex the leg, and walking or hopping caused no pain. Moreover rotation, inwards or outwards, gave rise to no discomfort whatever.

Oct. 10th.—On this day I saw him again. He had been walking for seven or eight miles a day, and had even been out shooting. There was no effusion, heat, or tenderness, and he could move the leg perfectly in every direction; the scar was

quite sound. As he was returning to Cambridge, he asked me whether he could "go in" for rowing and football, but I advised him to postpone such exercise till after Christmas.

In this case the portion of internal semilunar cartilage that was removed measured 1½ inch in length, the anterior extremity being thickened and rather inflamed.

I did not employ a drainage-tube in this case, and thereby, in my opinion, subjected the patient to considerable pain and discomfort. Had drainage been resorted to for the first forty-eight hours, so as to allow of the escape of any excess of synovia, the patient would have been spared the pain occasioned by the distension.

Dec. 9th.—He was seen again and was quite well.

In July 1889 this patient wrote to me, stating that, after jumping from a height, he had experienced a pain in the knee-joint, probably caused, in my opinion, by jamming the femur on the tibia. As there was now no cartilage in the joint to act as a buffer, the jamming set up some inflammation, followed by effusion. This effusion went down, but the patient then complained of his joint occasionally fixing; it seemed as if the tibia slipped in front of the femur and was for a moment fixed there.

As he is abroad, I have not yet been able to see him.

Since this was one of my early cases in which I used to open the joint by a *transverse* incision, it is possible that I weakened the structures supporting the inner side of the joint. Thus too wide a separation may have been allowed between the tibia and the femur, and they may have been given a chance of locking.

Out of the eight cases on which I have operated, this is the only one in which such a condition has followed.

I have sent the patient a moleskin knee-cap, which, I hope, will cause the parts to become firmer, and so stop the trouble. Up to the time of the jump he had been playing tennis, cricket, &c., without the slightest discomfort.

Mr. Atkinson, of Leeds, has very kindly furnished me with, and allowed me to publish, the notes of two cases upon which he has recently operated for internal derangement.

CASE III.—"J. R., aged 38, miner, admitted into the Leeds Infirmary on Feb. 27, 1889.

"Fourteen months ago his right knee was injured by a fall of three or four feet. Since then it has from time to time 'let him down' suddenly, with very severe pain.

"On admission, a very small ill-defined body could be felt on the inner side of the joint, corresponding to the upper margin of the head of the tibia. On flexing the joint, some creaking was to be felt.

"On Feb. 28th, Mr. Atkinson made an incision, about 1½ inch in length, on the inner side of the joint, and found the inner margin of the inner semilunar cartilage detached from the tibia and curled up, so as to be pressed upon by the inner condyle of the femur at every movement of the joint. As much of the cartilage as was detached was cut away with curved scissors, and the edges of the wound brought together by sutures.

"The wound healed by first intention, but a little synovitis followed, which soon subsided.

"On March 26th, passive motion was employed under chloroform, and the patient was allowed to go out wearing a leather knee-cap."

CASE IV.—"J. A., aged 37, admitted June 18, discharged July 13, 1889.

"He came in complaining of severe pain in the right knee-joint, and inability to extend the leg properly.

"History.—Five months ago, when kneeling at

his work (a coach painter), he experienced great pain in the right knee and found that he could not get up again without assistance.

"Since then he has had many attacks of a similar nature; sometimes one comes on very suddenly when he is walking about, the knee 'letting him down' with a sickening pain.

"After each attack he has had considerable difficulty in completely extending the leg, and has usually succeeded in doing so by alternate flexion and extension.

"On the morning of admission, when turning over in bed he felt the same sickening pain in the joint, and could not by any means get the leg straight again.

"On admission, the right leg was slightly flexed on the thigh and could not be fully extended. There was little or no swelling of the joint. There was a very painful spot on the inner side of the joint, corresponding to the upper margin of the head of the tibia.

"June 20th.—Mr. Atkinson made an incision, about 2½ inches in length, on the inner side of the joint, parallel to and on a level with the upper margin of the head of the tibia. He found that the anterior third of the internal semi-lunar cartilage was detached from the tibia and

doubled up under the femur; it had also become firmly attached in front to the capsule of the joint and so could not be returned to its proper position.

"The piece of displaced cartilage, about 1 inch in length, was cut away with scissors. Both superficial and deep sutures were inserted, and antiseptic dressings applied.

"June 28th.—Dressings removed and the wound was quite healed."

Mr. Annandale, in the *British Medical Journal* for Feb. 9th, 1889, related the following case:—

Case V.—"R. U., aged 38, a strong, healthy miner, applied to me at the Royal Infirmary on July 11th, 1888, for advice in connection with the result of an injury to his left knee. His history was that he had enjoyed excellent health, but eleven months previously, when at his work, a mass of coal fell upon his leg and knocked him down. In his struggles to get up he gave his knee a severe twist, and it was with some difficulty that he got home. He did not use any treatment, but the joint was swelled and stiff for some days. He returned to light work, but found that the movements of the joint were uncertain, and that sometimes it would suddenly become 'locked.' During the last few months

the interference with the functions of the joint had become more frequent, and he began to feel something 'moving' in the joint, and when the knee became fixed it required some little manipulation to restore its movements. As he was unable to work properly at his employment, he was very desirous to have something done to relieve him. An external examination of the joint did not detect any unnatural condition, except that there was a slight effusion into its cavity. At times the movements of the joint were free, but during some action of the limb the knee would become fixed, and give rise to pain over the region of the internal semilunar cartilage, until manipulation had unlocked the articulation.

"On July 18th I exposed the affected cartilage by my usual incision [transverse], and the joint having been freely opened, the condition illustrated in the woodcut was seen. I then excised the greater part of the cartilage, a small portion of its posterior margin being left, as it could not be easily reached. No drainage was employed, and the patient made a perfect recovery, the temperature chart showing that during his progress after the operation his temperature never rose above 99.3° F. He left the hospital well upon August 16th, and was advised to

commence careful movements of the joint. The patient returned to show the result of the operation in December, and it was then found that the joint-movements were quite natural, and he was carrying on his employment successfully.

"The condition of the excised cartilage in the case is illustrated in the woodcut; and in addition to the tongue-like portion of it (see A), which had been partially torn away, the body of the cartilage itself was thickened and undergoing a form of fatty degeneration. Had the cartilage been healthy I should have confined the operation to the excision of the projecting portion."

FIG. 9.

Mr. John Croft, in the *Clinical Society's Transactions*, vol. xxi, 1888, recorded the following case :—

CASE VI.—"John N., aged 39, labourer, was admitted into St. Thomas's Hospital on April 20, 1887, and discharged, cured, on June 15 of the same year.

"He suffered from 'rheumatic fever' eight years ago. The right knee was blistered three or four times during that illness. He recovered without lameness. He had not experienced any accident

to the joint prior to three weeks before admission. At that time he slipped, his foot gave way, and he fell on his right knee. On trying to get up he found that he was not able to straighten the knee. The joint did not swell.

"On admission, he complained of the right knee giving way on walking, and of great pain at such times. He was unable to follow his employment. On examination, the knee was observed to be free from any synovitis, and to be free in its movements backwards and forwards, and these movements did not cause pain.

"During repeated examinations of the knee, whilst in bed, the internal semilunar cartilage could be occasionally displaced, then the act of extension became limited, and complete flexion caused pain. The evidences of displacement were as follows:—First, in flexion to a right angle, what appeared to be the rounded thick outer border of the cartilage could be felt projected and prominent between the tibia and the femur; secondly, on attempting extension a small hard lump might be felt in front of the internal condyle, between it and the ligamentum patellæ; and thirdly, the movements became restricted.

"He was watched for a fortnight, during which time he was allowed to go about the ward. The

'internal derangement' of the joint frequently recurred. Attempts to reduce the displacement caused only temporary improvement. I perceived that the use of the appliances ordinarily employed in cases of so-called dislocation of the cartilage would prove of little or no benefit, and therefore I advised him to submit to an operation for the cure or permanent relief of the condition.

"My intention or plan was to open the joint, and if I found the cartilage separated from its anterior attachments, to refix it as Mr. Annandale had done in at least four cases at the Royal Infirmary, Edinburgh.

"On May 5, I opened the knee-joint by a transverse incision over the semilunar cartilage, commencing about an inch from the edge of the ligamentum patellæ. The incision was $2\frac{1}{2}$ inches in length in the integuments, but not so long in the synovial membrane. On opening the joint, I discovered that the cartilage in question was still fixed by its anterior and posterior extremities, but was at that *moment displaced into the intercondyloid notch,* having been torn from its circumferential relations. On pulling it into view, it was found to have a small tongue-shaped piece projecting upwards from about its middle. This

process was smooth on its upper surface, but striated underneath, where it had been recently torn up from the body of the fibro-cartilage. This was a worse condition than I had expected.

"I cut through the anterior and posterior insertions, and drew out the intervening portion, which consisted of about three-fifths of the cartilage (Fig. 10). When all bleeding had been stopped, and the joint cleansed, the cut edges of the synovial membrane were brought together with fine catgut sutures, except where drainage was provided. The superficial wound was closed by silk sutures. A catgut drain was inserted, and antiseptic dressings applied.

FIG. 10.

The excised portion of cartilage.

"On the third day after the operation, the temperature rose to 101.4° F., owing to tension of the joint. The drainage was imperfect. The capsule had become distended by a considerable quantity of fluid. This fluid was drawn off, and from that time he had an uninterrupted recovery.

"On the twenty-seventh day after the operation he was allowed to get up; but as the joint quickly filled with fluid he was directed to keep

posture, and port was

given. On the fortieth day he was pronounced cured, and was discharged.

"On Oct. 31st, about four months later, he presented himself for inspection. He had been in full work for some time. The knee had not caused him any inconvenience. He could carry 200 lbs. weight on his back, up ladders, without experiencing any fatigue in his knee. He was not wearing any support. This result is entirely satisfactory. He has not missed the semilunar cartilage. The severance of the internal lateral ligament and capsule has not weakened the joint."

CASE VII.—The following case was reported by Mr. Bowlby, for Mr. Langton, in the *Pathological Society's Transactions*, 1888, p. 282:—

"The specimen which was shown was removed from a healthy man, aged 26, who had frequently wrenched his knee while playing football and cricket, and had lately suffered from all the symptoms of loose cartilage. On admission into St. Bartholomew's, a loose body was readily felt in the left knee-joint. It was placed on the outer side, and its range of movement was somewhat limited. The loose body was removed by Mr. Langton, who found that the external semilunar cartilage had been torn from its posterior attachment, and was further detached laterally from one-half

or more of its length. The torn piece of cartilage was severed from that portion which remained attached, and was removed." The specimen is in the museum of St. Bartholomew's Hospital (No. 721).

CASE VIII.—In the *Pathological Society's Transactions* vol. xxxix., 1888, p. 289, is recorded a case by Mr. T. Lediard:—

"An internal semilunar cartilage was removed from a patient, aged 19. The knee was first injured eighteen months prior to operation when he was taking a long jump. Subsequently various injuries at football and cricket caused repeated attacks of synovitis, after which a loose body was frequently found to project from the inner side of joint. On cutting down upon the supposed loose cartilage it was found to be a loop of ligamentous appearance. On hooking the loop a free end appeared, but the other end was thick and fixed to near the spine of the tibia, and was cut away with scissors. The specimen, which measures 3 inches long by a quarter of an inch wide, is stout and fibrous towards its attached end, but thin and frayed out at the free end. It is believed to be the internal semilunar cartilage.

"The patient has felt no inconvenience in the joint since."

CASE IX.—In the museum of Charing Cross

Hospital is a specimen removed in the following case, which Mr. John Morgan has kindly allowed me to relate. A man, aged 36, had a few years before fractured his femur into the right knee-joint, which developed symptoms of loose cartilage. Mr. Morgan cut into the joint and found that the piece of cartilage, which he removed, was attached by a broad base to the edge of the internal semilunar cartilage of the knee. The patient made a complete recovery. From an examination of the specimen, the portion Mr Morgan removed was evidently a piece of the semilunar cartilage which had been split off.

I shall now cite cases in which the semilunar cartilages were sutured to the head of the tibia.

CASE I.—In the *British Medical Journal* of May 26th, 1888, I related the following case :—

In September 1887, J. W., carman, aged 33, came to me at the Surgical Aid Society, and said that I had seen him some months back when he had applied for a knee-cap. He had stated on that occasion that, about one year previously, when carrying a heavy load, something had slipped in his right knee, and that he had to rest the joint, which was very painful and swollen, for some time; after the first accident he was constantly being laid up with the disordered knee,

but rest was of no avail. Each time he returned to his work the old symptoms recurred within the space of a few days. At that time, he said, I had ordered him a strong knee-cap, which, unfortunately, had been of little use.

I then went carefully into his history, and found that he had detailed all the symptoms of a slipped semilunar cartilage. Accordingly, as he was a young man and healthy, and as he had asserted that, unless something was done, he would have to give up his work, I proposed that the cartilage should be fixed, and explained to him the supposed risks of the operation; these he readily consented to run. I therefore sent him to the Great Northern Hospital, and on September 28th performed the following operation:

The right knee was thoroughly washed and enveloped in wet antiseptic bandages for some hours. A vertical incision, 3 inches long, was made over the internal aspect of the joint, the centre of the wound being over the internal cartilage. The joint being opened, I introduced my finger with some difficulty, and felt that the internal cartilage could be freely moved about over the head of the tibia, both forwards and outwards. Fixing it with my finger, I then passed a strong needle, mounted on a handle, through

the periosteum at the head of the tibia, and through the semilunar cartilage. The needle was threaded with stout catgut, which was drawn through the cartilage and periosteum, and then tied up tightly, so as to fix the cartilage. After this the joint was distended with carbolic lotion, and the cut edges of the synovial membrane carefully brought together with buried catgut sutures. Superficial silver sutures were passed through the skin, no drainage-tube being used.

The leg was then fixed upon a back-splint with a foot-piece, which extended up to the gluteal fold. Antiseptic dressings were applied, and the whole leg bandaged, so as to obtain firm equable pressure over the knee.

Sept. 29th.—Had a fair night. Vomited once, and complained of a little starting in the knee, so an ice-bag was applied. Temperature, every six hours, showed 97.6°, 98°, 99°, 99.6°.

Sept. 30th.—Pain had entirely gone. Ice still continued. Temperature, 99.8°, 100.4°, 99.6°, 100.6°.

Oct. 1st.—Had a comfortable night. The temperature fell from 101° to 100°, then to 98.4°, and never rose again above normal.

Oct. 2nd.—I dressed the wound; there was no pus, and no effusion into the joint. Antiseptics were

reapplied; ice discontinued; and the leg not so firmly bandaged, as it was slightly œdematous.

Oct. 7th.—Removed the dressings; all the wound was healed; the superficial stitches were removed. No effusion. A pad of cotton-wool was applied to the wound, antiseptics being left off.

Oct. 19th.—On the leg being removed from the splint, the patient could bend it nearly to a right angle upon the thigh; but, as it was still a little stiff, and as I did not wish him to use it until the adhesions were sound and firm, I would not let him stand upon the leg until November 1st.

The patient wrote to me on April 16th, 1889 (one year and seven months after the operation), saying that he continued quite well.

Case II.—I take the following account of another case of mine from the *Great Northern Hospital Reports*, 1889:—

On Jan. 14th, 1889, Elizabeth B., aged 16, was admitted into the hospital. During the previous October she had jumped off her bed on to the floor, and had fallen with her right leg under her, a sharp pain being felt on the inner side of the right knee. For some minutes she could not get up or bear the weight of the body on

the right leg; when she did rise, her leg was rather flexed, and sharp pain on the inner side of the knee was experienced on attempting to extend the leg.

She returned to her work in an hour's time; but a good deal of pain continued to be felt in the same place, and the knee became swollen and hot. On the third day after the accident she went home, and was for three weeks under the care of a doctor. After this she could walk very fairly, but was subject to frequent attacks of throbbing pain and slipping on the inner side of the knee, which used to last for two or three minutes.

She then went back to her work, and remained at it until a fortnight before admission into the Great Northern Hospital. On that date she was walking upstairs when she experienced a sudden sharp pain on the inner side of the right knee. The knee gave way under her, and she fell with the foot everted. Once more the joint became swollen. The leg was flexed, and was pulled straight by her mother; a similar experience recurred four days before admission; indeed, for the whole of the preceding fortnight she had had constant trouble in the joint.

Jan. 14th.—On admission, nothing abnormal was

to be seen about the right knee, and movements in every position were quite free. There was no heat or swelling about the joint, and no throbbing at night. The patient was rather afraid to stand on the leg, and was inclined to keep it in a slightly flexed position.

On an examination being made, at the front and inner side of the joint, just on the inner side of the ligamentum patellæ could be felt a longish body, which was fairly movable at its anterior part, but became lost towards the back of the joint. This was situated exactly between the femur and the tibia, was pushed forwards when the leg was extended, and could be replaced in the joint when the leg was flexed. My diagnosis was, that the internal semilunar cartilage had been torn away from its anterior attachment and from some of the coronary ligaments.

Jan. 16th.—Ether having been given, an incision about 3 inches in length was made on the inner side of the knee-joint, parallel with and ¾ inch from the ligamentum patellæ. Bleeding was controlled by clips. The synovial membrane was then opened. On examining the interior of the joint it was found that the internal semilunar cartilage was detached and loose at its anterior extremity, so that the finger could be put

directly on to the head of the tibia. The loose end of the cartilage was then fixed to the fibrous tissue at the head of the tibia by means of a catgut ligature. The wound was thereupon closed with silkworm gut sutures, the synovial membrane being included in the stitches. A small drainage-tube was inserted into the joint from the lower end of the wound. No ligatures were used for the vessels.

The cavity of the joint was then well irrigated with carbolic acid lotion (1 in 40), and wet carbolised gauze, salicylic wool, and an outside dressing were used. A long back-splint and inside and outside splints were also applied, and the leg was firmly bandaged. The operation lasted forty minutes.

Jan. 17th.—There was considerable vomiting for the first few hours after the operation ; the patient was somewhat hysterical, but had no pain, and slept well later on. In the morning there was a little sharp pain on the inner side of the right knee ; the tongue was clean and moist ; temperature, 99°.

Jan. 18th.—The previous evening the temperature rose to 100.2°, but the patient was quite comfortable save for a slight tightness in the knee. There was a little tenderness on pressure on the inner side of the joint. The morning tem-

perature was 99.2°. In the afternoon the wound was dressed as before. There had been a good deal of serous oozing; there was no tension or effusion, nor was there any tenderness or pain on movement.

Jan. 22nd.—The wound was dressed (temperature rising to 100.2°), and was found to be nearly all healed. The sutures were not removed, but the inside and outside splints were discontinued; there was no pain or swelling about the joint.

Jan. 28th.—On the 26th the wound was redressed, and was all healed except quite superficially. It was quiet in every respect. Most of the stitches were removed, and strapping put on.

Feb. 9th.—The splints were left off, and the patient got up.

Feb. 15th.—The patient was discharged cured, but was advised to wear an elastic knee-cap.

Sept. 20th.—Saw the patient again; there was perfect movement in the joint, and she was completely cured.

Another of my cases is recorded in the *Great Northern Hospital Reports*, 1889.

Case III.—On February 27th, 1889, Amelia G. was admitted into the hospital with the following history:—

A year before, she had fallen down in the

street, with the left knee bent under her. After rising she had rested for about five minutes, and had then walked home, but felt considerable sharp pain on the inner side of the knee. The knee became slightly swollen, and this swelling did not subside for some days. Two or three days after the accident the knee was strapped, but for six weeks she was unable to leave the house. At the end of this time she returned to work, but had difficulty in standing, and felt pain and slipping on the inner side of the knee. She was always free from pain and stiffness in the early morning, but the joint generally began to ache after a day's work. She had trouble in getting up from a kneeling position, and in the act of rising used to experience the sensation of something "jumping in the joint" on the inner side. In consequence of all this she was frequently obliged to desist from work for three or four weeks at a time. She also stated that sometimes when she moved about while lying in bed there was a sudden sharp pain on the inner side of the joint, and that then on straightening the limb "something seemed to go back into the joint." Occasionally a similar sensation had occurred whilst she was out walking, especially if she was rather tired, but the pain had never been severe enough to cause her to fall.

On admission she was seen to be able to flex and extend the joint quite easily. On examination, no effusion or thickening of the synovial membrane was discovered, nor was there any enlargement of the ends of the bones. Moreover, there was an absence of additamentary growths. On the inner side of the joint, over the head of the tibia, there was a tender spot; and on deep pressure a body could be felt to move with its long axis across the joint. The pressure caused considerable pain.

March 8th.—On the previous day ether was given, and a vertical incision, about 4 inches in length, was made over the inner and front aspect of the joint. Upon opening the joint air rushed in with a distinctly audible noise. The internal semilunar cartilage appeared to move on the head of the tibia rather more freely than was natural, but could not be raised from it. It was therefore fixed to the surrounding fibrous tissue by means of a catgut ligature. The joint was then irrigated with perchloride lotion (1 in 2000), and the wound was sewn up with silkworm gut sutures, the synovial membrane being carefully included in the stitches wherever it corresponded with the wound. No ligatures or drainage-tube were used, but the customary carbolised gauze,

salicylic wool, and outside dressings were employed. The leg was then put in a back-splint and two side splints. As during the night the patient had some pain in the knee, an ice-bag was applied.

March 9th.—A comfortable day had been passed, with very little pain. There was slight tenderness on pressure over the patella, but no fulness could be made out. The morning temperature had been 100.2°, the highest reached heretofore.

March 13th.—The wound was dressed, and the union was found to be very satisfactory; there was no redness or tension, and no effusion into the joint. The sutures were left in, and antiseptics were re-applied.

March 16th.—The wound was re-dressed, and all the stitches were removed. The union was now very firm. Strapping was put over the wound, the antiseptics and side splints were discontinued. The patient was allowed to get up.

March 19th.—There was slight œdema of the leg, and the temperature rose to 100.6°.

March 22nd.—The œdema had subsided, and the union of the wound was firm.

March 31st.—The patient could walk fairly well, but after walking much she still had sl

œdema of the foot and leg. She was discharged, and told to return if again troubled with her knee.

August.—I regret to say she never came to the hospital again; so I presume that she has been completely cured.

Case IV.—Mr. Annandale recorded the following case in the *British Medical Journal*, April, 1888, page 779:—

"Thos. M., aged 30, miner, was sent to me from the north of England, on November 1st, 1883, with the following history. About ten months before his admission, he was working in a kneeling position, when he felt something give way in his right knee. He suffered sharp pain, but continued at his work for a few hours. Great swelling of the joint followed, and the pain became much aggravated so that he could not return to his work, and he had not since worked at his occupation. The condition was treated by rest, blistering, the application of iodine, and various liniments, with the result of reducing the swelling; but the pain still continued, and the movements of the joint were interfered with by something 'slipping' in the knee.

admission, the joint was slightly swollen,
a small amount n into its

cavity. The patient complained of acute pain in certain movements of the joint, which frequently became locked in the flexed position. He was able, by a little manipulation, to unlock the joint, but the frequency of this symptom made him quite unfit to follow his employment as a miner. On careful examination of the joint, there was a well marked hollow over the anterior border and position of the internal semilunar cartilage This hollow was most marked when the knee was flexed. Having decided that the case was one of displaced semilunar cartilage, and one not likely to be cured by any ordinary treatment, I, on November 16th, performed this operation.

"An incision was made along the upper and inner border of the tibia, parallel with the anterior margin of the internal semilunar cartilage; and, the few superficial vessels having been secured, the joint was opened. It was then seen that this semilunar cartilage was completely separated from its anterior attachments, and was displaced backwards about half an inch. The anterior edge of this cartilage was now seized by a pair of artery catch forceps, and it was drawn forwards into its natural position, and held there until three stitches of chromic catgut were passed through it and through the fascia and periosteum

covering the margin of the tibia. The forceps were then withdrawn, the cartilage remaining securely stitched in position. The wound in the synovial membrane and soft textures having been closed with catgut stitches, a splint and plaster-of-Paris bandage were applied, so as to keep the joint at rest. The progress of the patient, after the operation, was perfect, the temperature never rising above 99° Fahr. Seven weeks after the operation, the splint and bandages were removed, and gentle movements of the joint practised.

"On January 25th, 1884, the patient was dismissed cured, the movements of the joint being good, and the limb steadily gaining strength. In April of the same year, the patient returned to show the result. He was then seen and examined by many of our distinguished guests at the tercentenary, who all expressed the opinion that the result was everything that could be desired. He had perfect movement in the joint, and had never had the slightest stiffness or locking of the joint since he commenced to go about after the operation."

Again, Mr. Annandale, in the *British Medical Journal*, February 1887, recorded the three following cases:—

Case V.—"U. B., aged 32, a gardener, was admitted on November 1885. He had

suffered from symptoms of displaced internal semi-lunar cartilage of the right knee for one year, and he attributed his symptoms partly to constant kneeling at his work and partly to a twist of the joint. As ordinary treatment failed to relieve, and as he was unable to follow his employment, the usual operation was performed. When the knee-joint was opened it was seen that the affected cartilage had been almost entirely torn away from its anterior attachments and was folded backwards upon itself, lying towards the inter-condyloid notch. It was drawn into position and stitched there by catgut sutures. The splint was retained for six weeks, when it was removed, and movements of the joint practised. This case also was completely successful, and the patient was seen six months afterwards, when he was actively engaged at his work."

CASE VI.—"J. G., aged 35, a miner, was admitted on July 19th, 1886, suffering from symptoms similar to those in the last two cases, which had existed for about nine months. The knee affected was the right one, and there was no distinct history of an injury. The usual operation was performed on July 21st, and the patient was dismissed, with the splints still applied, on August 24th. He returned at the end of a month,

the splints were removed, and movement of the joint ordered. Six weeks after, he again returned, when it was found that his symptoms were greatly relieved, and the movements of the joint were natural, except that he could not flex the knee to quite the full extent; otherwise the limb and joint were perfectly right. In this case the internal semilunar cartilage was found to be only partially separated from its anterior attachments."

CASE VII.—"U. U., aged 28, a soldier, admitted November 4th, 1886. Six months before admission, he was running quickly down some stairs, when he fell, his left knee receiving a severe twist. He was carefully treated in the military hospital for several weeks, and at the end of this time he could walk a little, but only with the injured limb in the straight position. When he tried to bend the knee, he felt something 'give' in the joint, and it became locked, but by a little manipulation and movement of the joint he could relieve the symptom. There was tenderness over the position of the external semilunar cartilage, and in certain movements of the joint the cartilage could be seen and felt to be displaced. The operation for replacing and fixing the cartilage was performed upon November 11th, and he was

ed with the splints upon December

13th. He returned at the beginning of January of this year, when the splints were removed, and movement of the joint ordered. On February 2nd the patient was walking with a strong and useful leg. The movements were not yet perfect, but the old symptoms had entirely disappeared."

CASE VIII.—Mr. Davies-Colley, in the *British Medical Journal*, March 17th, page 588, vol. i. 1888, mentioned a case on which he had operated five months previously. The patient was a gentleman, aged 21, who was riding, when his horse reared and fell on his knee, which soon became much swollen. All did well, however, until some six months afterwards, when, as he was playing lawn-tennis, his knee-joint became dislocated outwards, abducted, semiflexed, and fixed. The dislocation was reduced, but synovitis followed, and the dislocation thenceforward recurred frequently, causing severe pain. Often when on horseback he had to roll off his horse in order to rectify the dislocation, which was not prevented by knee-caps, &c. Mr. Davies-Colley then proceeded to operate in the manner which Mr. Annandale had described. He found that the internal cartilage had two rents in it running parallel, and thus dividing the cartilage into three ribbons. It had doubtless been split

at the time of the original accident, improved by the two months' rest which followed it, and then again separated by the sudden strain during tennis. He had stitched the strips together so as to fix them to the internal tuberosity of the tibia. The case did fairly well. There was at first a discharge of gelatinous material from the joint, but after a fortnight this ceased and the catgut sutures were discharged at intervals. After two months the patient could bend the knee through an angle of about 60°, and he could now walk about four or five miles wearing a support which kept the knee fixed. Mr. Davies-Colley did not think it would be right to allow the patient to use his joint without support until six or eight months after the operation.

Mr. Edmund Owen reported the following case in the *British Medical Journal*, Nov. 24th, 1888:—

Case IX.—"R. H., a policeman, came to the hospital at the end of last December, complaining of there being 'something loose' in the right knee-joint. On being asked the exact spot, he placed his finger over the inner fibro-cartilage, which, on his bending and straightening the joint, could be clearly felt to slip from its proper position. He said that sometimes, when he was walking, the 'slip' was so serious that the knee

became 'locked,' that he suffered much, and that after the occurrence the knee swelled up, and that he had been temporarily invalided by the divisional surgeon. The patient was admitted on January 16th, at which time he had a considerable amount of effusion in the joint.

"On January 31st, the limb having been duly prepared, a two-inch incision was made a little in front of, and parallel with, the vertical axis of the joint, and, on the synovial membrane being opened, a large quantity of sero-synovial fluid escaped, and the front end of the semilunar disc was found to be loose, and curled into the gap between the condyle of the femur and the tuberosity of the tibia. The displacement was rectified, and the border of the cartilage was secured in position by a stout wire suture, which traversed the dense fibrous tissue around the margin of the head of the tibia. The joint was then washed out with mercuric solution, drained by a few strands of silk, and dressed with mercuric wool, the wound being closed by a continuous gut suture, and the limb being encased in a gypsum splint, which had been previously moulded for the purpose. Next day the temperature reached 100.6°, but higher than this it never ascended, and during the chief part of his convalescence it remained at normal.

At the end of six weeks he was discharged, but was advised to keep his knee stiff for a little while longer: a fortnight later, however, the limb was gently but fully flexed under an anæsthetic. He now uses the knee freely, has no pain nor inconvenience with it, and is about to resume his duty."

Mr. Mayo Robson, of Leeds, has just sent me these two cases, which he kindly allows me to publish:—

CASE X.—"G. S., aged 17, admitted to the Leeds General Infirmary, Feb. 18th, 1888, with a history of having suffered from a painful condition of the left knee for two years, during which time he had been occasionally seized with intense pain in the knee-joint, which was so severe as to cause him to fall immediately he felt it.

"For some time before admission the knee had become continually painful, and on flexion a clicking sound was noticed in the joint, although no loose body could ever be felt.

"On Feb. 23rd, after the limb had been carbolised and Esmarch's bandage applied, a transverse incision 1½ inch long was made parallel to and just above the head of the tibia, on the outer side of the joint, to which spot the pain had always been referred.

"The synovial membrane was opened and the

joint examined by the finger, when the external semilunar cartilage was found to be partly loosened from its attachment and much hypertrophied. As the cartilage was only attached behind, the anterior extremity slipped in and out of position each time the knee was extended and flexed, thus producing the clicking which had been complained of. It was brought into position and carefully sutured with catgut stitches to the periosteum of the head of the tibia. The joint was then syringed out with lotion, and the skin around closed with catgut sutures.

"The wound healed by first intention, and he was discharged cured on April 28th.

"The knee has remained perfectly well since the operation, although there has been hip-joint trouble, necessitating excision of the articulation."

CASE XI.—"J. M., aged 49, was seen by Mr. Mayo Hobson on Oct. 1st, 1888, the knee-joint being distended with fluid. The patient, who was a joiner, gave the history that for several years he had been liable to something slipping in his knee whenever he knelt at his work, and at times when he was walking. Usually he could put it right by forcibly flexing and extending his knee himself, but on two or three occasions he had had to come to the Infirmary to have the dislocation reduced.

"On Oct. 2nd, 1888, he came to the Infirmary complaining of the old trouble, which he had been unable to reduce himself or to get reduced. He was placed under an anæsthetic and reduction was attempted by forcible flexion, retention and extension, but without success.

"On Oct. 4th, after the knee had been carbolised, a semilunar incision was made across the inner side of the knee at the level of the upper part of the tibia, and the synovial membrane opened. On manipulating the limb the displacement of the internal semilunar cartilage was distinctly seen. The cartilage was only attached at its anterior extremity, the posterior end being folded forwards. On flexing and extending the limb after the joint had been opened the cartilage was observed to rotate outwards, so that the inner part of the upper surface of the tibia was left bare. After these observations had been made the cartilage was straightened and brought into position, being fixed to the periosteum of the head of the tibia by six catgut sutures. The joint was then syringed out with perchloride of mercury solution, the synovial membrane, capsule of the joint, and skin being afterwards stitched up separately. The wound healing kindly, a Thomas's splint was applied, and he was made an out-patient on Nov. 3rd, 1888.

The splint was worn about a month and then discarded.

"The natural movements of the joint gradually returned, and when seen in August 1889, he said his leg was as well and strong as ever it had been, that he was capable of kneeling and doing his work as well as ever. He could walk without any limp, and never felt any tendency to the old displacement."

I have also a case of exploration to report from the Great Northern Hospital. The patient was known to be suffering from rheumatic arthritis, but a slipped semilunar cartilage or piece of cartilage was also expected from the symptoms. As matters turned out, no slipped cartilage was discovered, but the event will show that the exploratory operation proved to be of much service.

CASE XII.—Robert H., a labourer, aged 47, was admitted into the Great Northern Hospital on the 26th March, 1889. Eleven weeks before admission, when trying to get out of bed, he felt a sudden pain on the outer side of the right knee. The knee was flexed and very painful; after rubbing it for some time something was felt to go back into the joint; the knee could then be straightened, and the pain was relieved. From

that time he had frequent attacks of a similar character, always brought on by some movement, the first attacks, but not the later ones, being attended with swelling in the joint.

Through this he had been able to do very little work; for the last two weeks he had been wearing a knee-cap, but without much benefit.

On examination, there was found to be no effusion into the joint, nor heat. There was considerable grating on the right knee being flexed: and over the external tuberosity of the tibia was a small flattened substance, which could be felt to move in and out of the joint when the knee was manipulated.

March 27th.—Ether having been administered, a vertical incision about 4 inches in length was made over the outer aspect of the knee-joint, about ¾ inch from the border of the patella. On opening the capsule, air entered the joint with an audible sound. Nothing abnormal could be found, beyond some roughness of the cartilage of the femur. The joint was irrigated with perchloride solution, and a small drainage-tube was inserted. The wound was sewn up with silkworm gut sutures, the synovial membrane being carefully included in the stitches. A back-splint and side splints were employed, and an ice-bag

put over the knee. There was a good deal of aching during the night, and, the patient could not sleep. There was tenderness over the joint on pressure.

March 29th.—There was less pain; as much blood-stained serum had come through the dressings, the wound was re-dressed. The drainage-tube was left in. Temperature 100.6°.

April 3rd.—Was re-dressed; the drainage-tube was removed. There was no effusion into the knee, but there was slight œdema over the joint and at the edges of the wound. Two stitches were removed. The patient complained of throbbing. shooting pain (in the joint) at night, but he had had similar pain before the operation.

April 6th.—Re-dressed, and all stitches removed. The deeper parts were healed, but the skin had not quite united on account of some inversion (of the skin) consequent on the œdema. There was still slight jumping pain at night.

April 17th.—The splint was removed, and the leg placed on a pillow between sand-bags. There was still some œdema round the joint, especially near the incision. There was tenderness on pressure, and some pain on movement. Temperature, 101°.

April 27th.—The œdema of the knee had gone

down a good deal, and the joint was far less painful.

May 10th.—The patient got up daily; he could bend his knee fairly well, but still could not walk on the leg.

May 12th.—He was discharged, and could walk very fairly.

Sept. 5th.—I have seen the patient to-day. He has no slipping pain, and had walked twenty miles, and expressed himself as being delighted with the result of the operation. The exploratory operation appears to have given him very great relief.

As the above twenty-one cases, in which the knee-joint has been opened, appear to have terminated in a highly satisfactory manner, it would be unseemly for me to criticize and to discuss too minutely the details used by the various operators. Nevertheless, I stoutly maintain that if this mode of treating internal derangements of the semilunar cartilage is to become popular among the profession, and be frequently used, the vertical incision for opening the joint is far the safer to employ. I need not here repeat my reasons for holding this opinion, for the merits of the vertical incision and its superiority to the transverse incision were fully discussed in the preceding chapter.

CHAPTER IV.

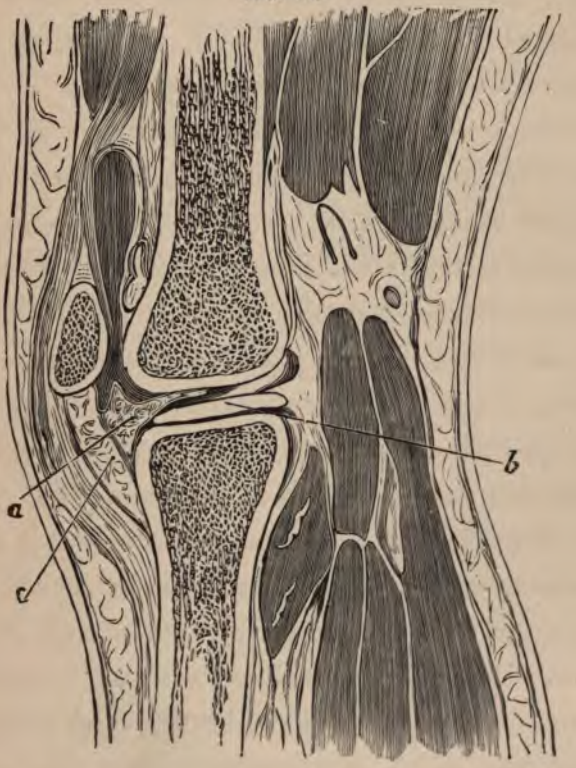
THE LIGAMENTA ALARIA.

In this chapter I am conscious of entering upon ground which has been hitherto untrodden, for nowhere in the literature of the knee-joint have I been able to find any case bearing upon the ligamenta alaria as the cause of internal derangements; nor, until *now*, has it been proved in the course of operation that these derangements are sometimes occasioned by the alar ligaments.

It may then be well, first of all, to turn our attention to the anatomy of these parts. As shown in Fig. 11, at *c*, there is a pad of fat covered by synovial membrane, and situated below the patella on a level with the tibia; this is called the ligamentum mucosum. Of this ligamentum mucosum the ligamenta alaria (*a* in the figure) are projections, and are themselves covered by synovial membrane. Each ligamentum alarium, indeed, is a mass of fat, having its base continuous with the ligamentum mucosum (*c*),

and its apex terminating at a very fine point, and attached (on whichever side it may be situated) to the condyle of the femur in the intercondyloid notch. There are usually, but not always, two of

FIG. 11.



these ligamenta alaria to each joint, which are continuous at their base. When there are two, the external one is generally smaller than the internal; but in some joints these relations may be exactly reversed. In 32 out of 55 cases which

I have examined, the internal was the larger; in the remaining 23 the external was the greater. Again, the alar ligaments vary in size in different individuals, being sometimes small, at other times large. It is important to note that they are attached to the intercondyloid notches by very delicate extremities. In some cases they are very lax and loose; in others they appear to be taut, and only just slack enough to allow of movement without being broken.

On referring to Dr. Scott Lang's most interesting and thorough explanation of the mechanism of the knee-joint, we shall see that these ligamenta alaria play a conspicuous part therein, though their importance in the movement of the joint may vary in degree in different cases. For an exposition of this I cannot do better than quote from Dr. Lang's valuable paper in the *Edinburgh Medical Journal* for 1886, p. 156. "The so-called alar ligaments," he writes, "are much more important than might be supposed from the usual anatomical descriptions. They are, as is usually stated, in the position of fringes of the ligamentum mucosum; but in many cases they will be found to be distinctly hard and cartilaginous, and, although variable in size and consistency, will always be found to be intro-

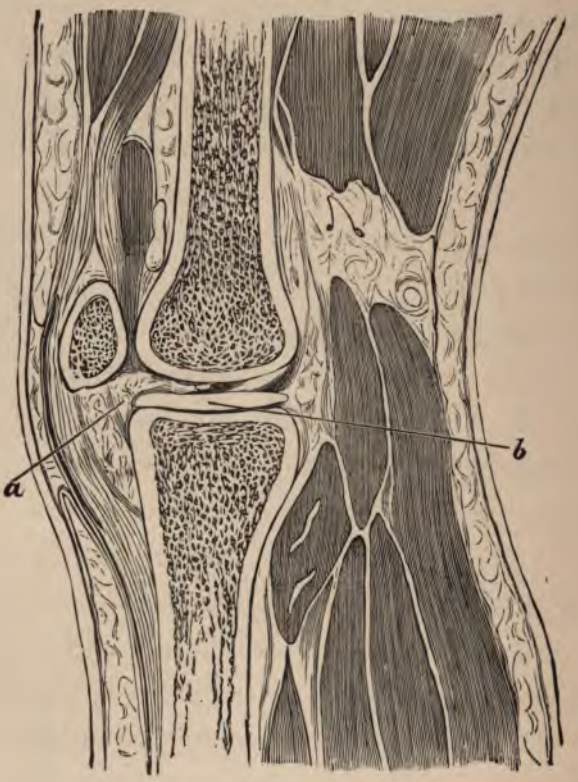
duced between the femoral condyle and the anterior portion of the semilunar fibro-cartilages in complete extension of the joint in a sound knee." This can be readily seen (as Dr. Scott Lang says, and as I have myself noticed) upon opening the joint, by cutting along the inferior margin of the patella, throwing forward the capsular ligament, and noting the position assumed by the alar ligaments when the joint is flexed and extended. This can also be thoroughly demonstrated by making an oblique vertical section through the internal condyle when the joint is completely extended.

Now in some joints any deficiency in the internal semilunar cartilage at its anterior part is evidently then made good by a large cartilaginous pad. Goodsir, indeed, uses this word "pad" to represent the alar ligament in its enlarged state when supplying such a deficiency. It must be borne in mind therefore that, as in extension, the alar pads come between the femur and the semilunar cartilage, any undue lengthening or thickening of these structures may alter the mechanism of the joint and give rise to abnormal symptoms.

Let us suppose that one of the alar ligaments (probably the inner one, from its greater import-

ance) has received some injury, such as hæmorrhage into it, or is thickened in consequence of chronic inflammation, itself the result of injury. It then undergoes enlargement, and on movement

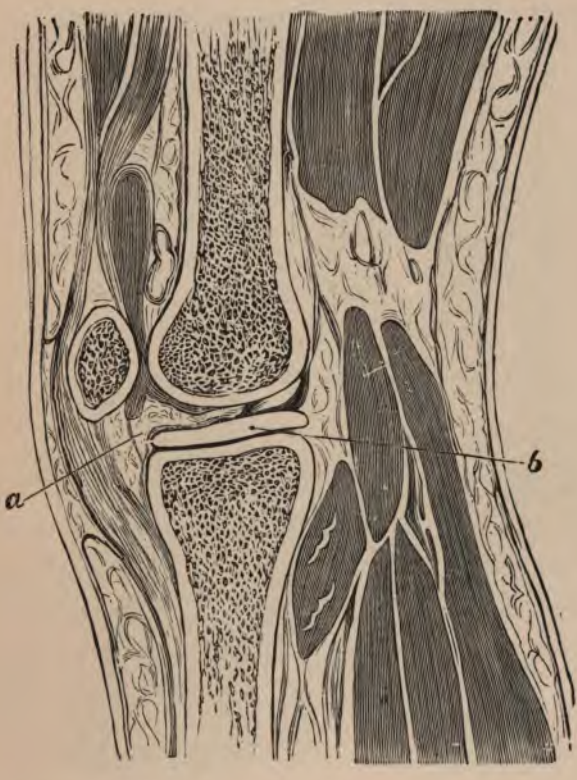
FIG. 12.



of the joint in extension, a condition may be produced as shown in Fig. 12—viz., the alar ligament or pad (*a*) may be pinched between the femur and the semilunar cartilage (*b*).

Again, as shown in Fig. 13, when in flexion of the joint the semilunar cartilage (*b*) goes backwards, the alar pad (*a*), if enlarged or stretched, may fall in front of it, and thus, on extension,

FIG. 13.



may become pinched between the ligamentum mucosum and the front of the semilunar cartilage (*b*).

There is another condition (Fig. 14) in which

I am inclined to think the ligamenta alaria may interfere with the mechanism of the joint. We know that from excessive kneeling the ligamentum patellæ (*d*) may become enlarged and

FIG. 14.

thickened. The chronic inflammation which ensues may spread to the ligamentum mucosum (*c*), and the ligamentum alarium (*a*) be thus pushed far into the joint, and be constantly

nipped between the femur, semilunar cartilage (*b*), and ligamentum mucosum (*c*).

I admit that these conditions are more or less speculative, since there are very few pathological specimens relating to them; but they can all be produced upon the dead body by stretching the ligamenta alaria, slightly stretching the semilunar cartilage, or pressing upon the ligamentum patellæ. It can be proved that by flexing the leg completely upon the thigh the ligamenta alaria can be rendered tense, though in the dead body I have not yet succeeded in effecting their rupture. In the living, however, it can be easily understood that some sudden uncertain movement (say forced flexion), accompanied with rotation inwards or outwards, or perhaps with eversion, may occasion the tearing away of the alar ligaments from their attachments, or leave them in an abnormally lax condition, which may conduce to great discomfort in the knee-joint.

I should make the following classification of these diseases or displacements of the alar ligaments:—

The ligamentum alarium may be enlarged from inflammation, or from hæmorrhage into it; it may be elongated; it may possibly be torn away; or a

cyst or new growth may be developed therein. From any of these conditions either (or both) of the ligamenta alaria may be affected, and as a result

I. It may be pinched between the condyle of the femur and the semilunar cartilage (Fig. 12).

II. It may interfere with the movement of the joint, cause the pinching of the semilunar cartilage, and then itself be pinched between the latter and the ligamentum mucosum (Fig. 13).

III. It may be pushed into the joint by a thickened ligamentum patellæ and ligamentum mucosum, and consequently be nipped (Fig. 14).

I will now describe the few specimens I have been able to discover. After that I will narrate the two cases which I have operated upon and cured. Then will follow a discussion of the symptoms of these disorders, and, finally, I will suggest what I think to be the best modes of treating such ailments by operative procedure.

The best specimen relating to these alar ligaments is to be found in the museum of King's College Hospital (No. 1272), and is a fibro-cartilaginous tumour growing from the ligamenta alaria. It is somewhat circular in shape, and its measurements are an inch and a half in diameter, two-thirds of an inch in thickness, and half an inch in breadth.

A drawing of the specimen (Fig 15) Professor Groves, of King's College Hospital, has very kindly allowed me to make.

Fig. 15.

Another good specimen is in the museum of St. Thomas's Hospital (104 D), and was described by Dr. Shattock in the *Pathological Society's Transactions* for 1888. It is a pedunculated old hæmorrhage in the right alar ligament, evidently due to contusion, and is a case from the dissecting-room. The bone of the rest of the joint is quite healthy. The pedunculated body measures

4 cm. transversely; 3.2 cm. vertically; and 7 mm. in thickness.

In the museum of the Royal College of Surgeons (No. 1926) I have seen a knee-joint in which there are three small growths of apparently cartilaginous and osseous substance. The largest of them is attached to the crucial ligament, and has as neighbour a second pendulous body of smaller size and irregular shape. The third, which is intermediate in size and presents on its surface distinct nodules of cartilage, is fixed to the synovial membrane just below the patella. The third body appears to me to have been formed from the ligamenta alaria.

Besides these, while examining the museums and studying the literature of the subject, I have seen or read of other doubtful cases. I refer in particular to Dr. Weir, *American Medical Review*, June 26th, 1886, and to two or three specimens in the museum of St. Bartholomew's Hospital. In these instances pedunculated growths were removed from the inner or the outer side of the patella, the peduncles being under the patella or the growths being connected with the synovial fringes. I am inclined to think, though it is not absolutely so stated, that some of these removed pendulous growths were actually diseased or detached ligamenta alaria.

I will now record two cases on which I operated :—

Case I.—Private D., aged 20, was sent to me in October 1888, by my friend Dr. Wharton Hood. He related the following history. While on duty in the early part of 1888, he had knelt down on a piece of coal and his left knee had twisted to one side. Shortly afterwards the knee began to swell. He continued walking about for two days, but then the pain and swelling obliged him to go into Colchester Hospital. There he remained for six months, during the whole of which time his leg was in a McIntyre's splint ; it was also blistered and evaporating lotions were constantly applied. He was then discharged from the hospital and sent on duty again, but as soon as he resumed his occupation the swelling and pain returned, scarcely permitting him to walk. While walking, all of a sudden his leg would fly from under him and cause him to fall without being able to save himself. The pain was of a sickening character, and the swelling would force him to lay up for many days. The consequence was that he was about to be dismissed the service, but before this step had to be taken he was sent to Dr. Wharton Hood to see if anything might be done for him, and Dr. Hood, for his part, kindly entrusted the case to

me in the event of operative treatment being of any use.

When I first saw the patient, in August 1888, I found the knee to be in the following condition. There was nothing abnormal to be seen, for he had rested for a few days before coming up to London; but on pressure just above the external head of the left tibia pain was caused, especially when the leg was slightly flexed on the thigh. The external semilunar cartilage did not appear to be abnormally movable, but attempted rotation in the same flexed position caused slight pain. I explained to the patient the nature of the operation I thought necessary, the opening of the joint over the tender spot for the purpose of discovering the cause of the pain and of his constant slipping. He was very anxious to remain in the army, and I therefore considered this exploration to be justifiable.

Accordingly, on October 25th, 1888 (in the presence of Dr. Wharton Hood), I opened the left knee-joint by a transverse incision three inches in length, commencing just above the head of the tibia over the ligamentum patellæ, and extending outwards for three inches on the outer side of the joint. Many vessels were clipped. The synovial membrane was then opened to a corresponding

extent with the skin incision, and synovia flowed out. I carefully examined the attachment of the external semilunar cartilage, and found it in its normal position and not too freely movable. I then introduced my finger into the joint and diligently explored every portion of it, examining the synovial membrane around the outer part of the joint to detect whether I could feel any pedunculated body that might be the cause of the pain. On passing the finger under the patella, it was discovered that the ligamentum alarium had been wrenched away from its attachment to the intercondyloid notch, and could easily be pinched between the femur and the tibia. I accordingly brought the ligament's free extremity up into the wound, and fixed it there. The joint was then syringed with carbolic lotion (1 in 40) until the latter came out in a clear state. Hereupon a drainage-tube was inserted well into the joint and was allowed to rest just under the patella; lastly, twelve silkworm-gut stitches were passed through the skin and the synovial membrane so as to bring into exact apposition the cut edges of that serous cavity. Extreme cleanliness was observed throughout the operation. The whole limb was enveloped in gauze dressing, was placed on a splint which extended from the foot to the gluteal fold, and

was firmly bandaged from foot to thigh. The operation took one hour to perform.

The patient was seen again the same night; the temperature was 97°, and the skin cool and moist. There was a little pain in the knee, but no tenderness or swelling about the joint.

Oct. 26th.—Had had a fair night; temperature 100° at night, 99° in the morning. No pain or tenderness, no discharge through the dressings; but he complained of the bandages feeling a little tight.

Oct. 27th.—Good night; had a little pain off and on. A slight loosening of the bandage greatly relieved him. He moved the leg about too much, a proof that there was no pain or tenderness. Temperature, normal.

Oct. 28th.—There was no pain; morning temperature, 98.6°; evening, 100°. I dressed the knee and removed the drainage-tube. There was very little discharge through the dressings, and what there was was only synovia. No effusion into the joint or tenderness anywhere; everything was going on favourably. Antiseptics reapplied.

Oct. 30th.—Had had a little pain, and temperature had risen to 101°. I took off the dressings and removed a few of the sutures, which appeared to be pulling, as there was a little cellulitis about

the knee-joint, but quite outside the cavity of the joint. There was no effusion or tenderness on pressing on the patella; and he could turn the leg round while the splint was cleaned and bear the knee being jarred. Antiseptics were left off, and the wound, which had almost united, was dressed with dry salicylic wool. There was no shivering, and the pulse was quiet.

Oct. 31st.—Had a good night, with no pain; the temperature had returned to normal. There was no effusion into the joint, but the wound gaped a little where the sutures had been removed. All the cellulitis had disappeared.

Nov. 1st.—Little discharge from the wound. Temperature, 99° at night; normal in morning.

Nov. 4th.—There had been a little suppuration about the lower angle of the wound, and some œdema round the head of the tibia; but the joint was not affected. Temperature, 99.6°.

Nov. 6th.—There was still a little œdema about the outer side of the joint. Temperature, normal. There was no pain from the wound, which had slightly opened up at its lower part. The joint was normal, with no tenderness, pain, or effusion.

Nov. 9th.—The wound was healed, but there was still a little indura[illegible] over the tibia.

Nov. 14th.—As [illegible] was progressing

favourably, the leg was taken off the splints. The patient was told to move the leg about as best he could.

Nov. 16th.—The previous day he got up and walked about. He only complained of stiffness about the patella, and was unable to flex the leg completely. He had no pain whatever.

Nov. 17th.—Had a three-hours' walk, and returned with a little fluid in the joint.

Nov. 19th.—There was still some synovitis, and the joint was a little stiff, but the patient could walk well without any pain.

Nov. 21st.—He went home. There was a little effusion, but no pain whatever on any movement; the knee was still a little stiff, and the leg could not be completely flexed on the thigh. The wound was soundly healed and was not tender.

Dec. 24th.—Dr. Wharton Hood had received a letter from the patient, stating that he was perfectly well, could walk a long way, and could do anything with the leg. The old slipping pain had been completely cured. He ended his letter with thanks for what had been done for him.

This case admirably illustrates the great importance of bringing the synovial membrane well together. It will be seen that five days after

the operation some cellulitis developed. Now, if the synovial membrane had not been brought together, and the joint soon and safely shut off, some of the pus that formed in connection with the cellular tissue might, and very probably would, have found its way into the joint-cavity, and thus have led to its destruction.

Case II.—David O., a fireman, aged 30, was admitted into the Great Northern Hospital on October 18th, 1888. When a boy he had been treated by a bone-setter for a small bone which was said to be out of place in the left knee; this was reported to have been put back, and the trouble appeared to have ceased. Six months before admission to the Great Northern he slipped on some rails and fell on his left knee, which became rather swollen and painful. Nevertheless, he continued at his work; but the knee began to grow worse, aching almost constantly, and there were frequent attacks of sharp pain of a stabbing nature. From the middle of July 1888 he attended at St. George's Hospital for nine weeks, and was treated with a splint, with medicines, and Scott's dressing. There were no good results. After that he wore an elastic knee-cap, which he fancied made him worse; he could not work at all, and came to me at the Surgical

Aid Society, whence I sent him to the Great Northern.

On inspection, the left knee looked to be almost normal, except for some fulness about the tubercle of the tibia. There was no local rise of temperature, and no signs of effusion into the joint; but there was considerable fulness under the ligamentum patellæ, as if from enlargement of the bursa under the patella ligament. On the outer side of the knee-joint, just above the external tuberosity of the tibia, a rounded body could be felt, apparently the size of a hazel-nut. This, at times, disappeared, but could be brought out by the patient putting the knee in a position of extreme flexion; it could then be felt to move in and out of the joint. Over this spot the greatest pain was experienced.

Oct. 23rd.—The knee having been shaved and ether administered, a vertical incision was made along the outer border of the ligamentum patellæ, and its fibres were separated. The ligament itself was found to be considerably hypertrophied, but no distinct bursa could be felt underneath it. The incision was then prolonged upwards towards the outer border of the patella, and was gradually deepened until the joint was opened. A large amount of thickened fibro-fatty tissue was found

under the patella, about the anterior attachment of the external semilunar cartilage, and was removed by scissors. There was alsó a pendulous

FIG. 16.

mass in the joint (the enlarged ligamentum alarium, Fig. 16, the smaller of the two bodies), which was removed, and its stump fixed by sutures to the lower part of the wound. The semilunar cartilages seemed to be in their normal position. As there was a moderate amount of oozing, a drainage-tube was introduced into the joint; a deep catgut suture united the divided synovial membrane, and the wound was stitched up with silk-worm gut sutures. The upper stitches were made to include both the synovial membrane and the skin; the lower sutures only the superficial parts. The joint was well irrigated with carbolic lotion (1 in 40). The wound was

dressed with gauze and sal alembroth wool, and outside dressings were applied. The limb was firmly bandaged on to a back-splint, and two side-splints were put on. The leg was raised, an ice-bag applied over the knee, and an injection of morphia given. A comfortable night was passed, with no pain in the joint and no oozing through the dressings. The temperature was not raised.

Next morning there were no signs of effusion, and no tenderness on firm pressure. Temperature 98, pulse quiet.

Oct. 25th.—No pain had been felt since the operation, save for a slight "jumping" on first waking. Temperature just above normal; no tenderness on firm pressure over the knee.

Oct. 26th.—The leg was dressed; there had been some oozing of bloody fluid, but the wound looked very quiet, except for a little redness at the upper part. Three of the upper series of stitches were removed; there was no tension, nor was there effusion into the joint. The ice-bag was discontinued, and antiseptics were applied as before.

Nov. 3rd.—On the previous day the wound was dressed (for the second time). It was firmly healed, except for a very slight gaping at the upper

part. All the stitches were removed, and both antiseptics and side-splints were discontinued.

Nov. 10th.—All the splints and the dressings were removed, and the wound strapped.

Nov. 13th.—He now got up daily, but the knee was very stiff. Passive movement was begun, and some slight adhesions were broken down.

Nov. 19th.—The patient had been up for two days with Martin's bandage on the knee, which was a good deal less swollen, and capable of much more movement.

Nov. 28th.—There was still a little thickening of the synovial membrane and a little heat, but there was no pain or tenderness. The wound was firmly healed. The patient could now walk easily without the aid of a stick; he could bend the knee to a little over a right angle, and could get it almost perfectly straight. There was no pain or slipping when walking. On this day (Nov. 28th) he was discharged.

Dec. 10th.—He had returned to his work, with the knee perfectly well; there was no pain whatever on movement. As I have not heard from him since, I conclude that he has remained in a quite satisfactory condition; otherwise, I am sure he would have returned to the Great Northern Hospital.

I have preserved the masses removed in this case (Fig. 16). The larger of the two masses consists of fat and thickened connective tissue. It was removed from the anterior part of the joint under the patella, being situated between the capsule and the synovial membrane. Presumably it is the ligamentum mucosum in an enlarged state.

The smaller specimen is the enlarged and thickened ligamentum alarium. It is only the upper portion, the lower part or stump having been fixed into the lower angle of the wound.

This case is very interesting; it appears to me to show what I have described as the third variety of the conditions which may cause the ligamenta alaria to produce an internal derangement. It will be seen that the ligamentum patellæ was thickened and hypertrophied, and that the ligamentum mucosum was also condensed and enlarged. Hence the ligamenta alaria were pushed into the joint, and thus caused the symptoms related.

From the above cases it will be observed that the symptoms of these particular derangements of the knee-joint are of a very uncertain nature. The joint is in an apparently incurable state, and occasions such discomfort to the patient that

an operation is justifiable. There is pain of a "catching" nature, which is generally referred more to one side than to both sides of the knee; such a reference might lead one to ascribe the symptoms to some derangement of the semi-lunar cartilages. At times the swelling and pain compel the patient to lie up. There is usually some *one* tender spot in the knee, and, when the latter is extended, pain may be produced without warning. In both my cases, although the symptoms were referred to one side only, yet added to these was "dragging" pain in the joint *under* the patella.

Before an operation is resorted to, I presume that the following line of treatment would have been tried. First of all, there should be complete rest for a considerable period. If, on the patient resuming work, the trouble recurs, he should be put to bed again, and a systematic treatment be employed of blistering and firing the knee chiefly above the painful point. The inflammation thus created may cause the ligamentum alarium to contract, or become shrunken, or adhere to some part of the synovial membrane. By such means, no doubt, cures may often be effected. However, should this line of treatment fail, and renewed work bring on renewed pain

and discomfort, I certainly think that an explorative operation is justifiable.

It will be seen how difficult it is to diagnose whether these troubles arise from derangements of the semilunar cartilages or of the alar ligaments. When the symptoms are referred to one side of the joint in particular, on that side I should make a vertical incision as I do when dealing with the external or the internal semilunar cartilage; choosing exactly the same place, employing the same method, and paying the same attention to all details and to the suturing of the synovial membrane. If, however, the pain be said to exist directly under the patella, and not on any particular side, I should advise the opening of the joint on its outer aspect. Here are my reasons: because of the smaller size of the external condyle—when the leg is forcibly rotated inwards and also slightly inverted when in the flexed position—a better view can be obtained of the interior of the joint. In this position of the leg, and from this side of the joint, there is a greater amount of room; hence exploration with the finger is rendered easier, and the source of derangement can be more readily sought for and dealt with. On the other hand, from the inner aspect, where the condyle is larger, a less good view can be obtained, a less thorough examination

be made, and the derangement of the ligamenta alaria is much harder to treat.

When the surgeon opens the joint on the side to which the discomfort is referred, the semilunar cartilage on that side should be first examined; one should observe whether it is abnormally movable, or whether it is detached from its anterior extremity. In the latter case the treatment should be that advocated in a preceding chapter.

Nothing abnormal being found as regards the semilunar cartilage, a careful examination should be made of the ligamenta alaria by the introduction into the joint of a thoroughly cleansed finger. The points to be observed are—whether either or both of these alar ligaments are enlarged, or too loose, or torn away. If enlarged, I should snip it off near to the ligamentum mucosum, and should at the same time bring the stump up to and fix it into the wound. If too loose, I should rupture the intercondyloid attachment with my finger, bring the ligament up to the wound, and include it in one of the skin sutures so as to prevent its slipping back again into the joint. I do not think it would be wise to cut away a ligamentum alarium without bringing the stump up into the wound, for a vessel supplying the ligament may be injured, and bleeding may recur when the joint is closed.

Moreover, by cutting off the ligament and dropping the stump back into the wound, a piece of fat would be exposed which is not covered by synovial membrane, and a raw surface be left, from which suppuration might start, and end in destruction of the knee-joint. In all cases, then, in which an alar ligament may appear to be too large, too loose, or torn away, I should remove a small portion only, and stitch the raw stump well up into the wound. The after-treatment is the same as that applied to the semilunar cartilage, the use of splints, passive movement, and so forth.

I have now narrated my operations on the living and my experiments on the dead subject which relate to this form of internal derangements of the knee-joint. The theories I have propounded may be proved to be erroneous, or may be shown to rest on evidence which, at present at least, is insufficient. That may be; but few scientific problems have been solved without a resort to hypotheses. Whether mine remain mere hypotheses or become verified theories, further experience alone can show.

CHAPTER V.

LOOSE CARTILAGES, PEDUNCULATED CARTILAGES, VILLOUS OR HYPERTROPHIED FRINGES.

I HAVE thought fit to include under one chapter all the above conditions as giving rise to internal derangements, and have grouped them together, inasmuch as their symptoms and treatment are more or less similar.

On consulting the literature of this subject, I have met with many accounts of the first two varieties and have seen specimens in museums; but, as they are sufficiently common and well known, it is not necessary to describe more than one or two cases which are especially curious and interesting. It is not my intention to enter into any pathological disputes as to the formation and causes of these conditions, nor to inquire into whether they were originally extra-articular or were primarily formed in the joint, or in what part of the joint-structures they first developed. No doubt they are sometimes formed in either

position, and from any structure, bone, cartilage, blood, &c. The important point both for surgeon and for patient is, that they are in the joint, and occasion a number of symptoms which call for prompt treatment either of a palliative or of an operative nature.

The loose cartilages may have first existed as pedunculated growths which have been set free by the rupture of their attachments. However that may be, when the loose cartilages are free, they may slip from time to time between the articular surfaces and cause some of the symptoms presently to be narrated. When they are large they may be easily diagnosed, but if they are very small a vast amount of discomfort and obscure trouble may arise, and continue until the joint is opened and their presence verified.

The pendulous bodies or pedunculated cartilages are attached by one extremity to the synovial membrane, but are free at the other. These are of various sizes, and may occupy different positions. A large or small growth situated at the *upper part* of the joint may give rise to few symptoms, for it cannot be squeezed between the articular surfaces on account of the limited length of its pedicle. When the growth is thus seated or limited to the upper part of the articulations, pinching can only

take place between the femur and the soft structures of the joint.

On the other hand, a large or small pedunculated growth, if it be seated at the *lower part* of the joint, either in front or at the sides, may often be pinched between the femur and the tibia, and give rise to severe symptoms more urgently requiring active treatment.

What at first may appear to be a pedunculated body may, on further examination, prove to be only a hypertrophied fringe; yet, if this fringe is in a suitable place and of sufficient length, it may easily be nipped, and the nipping give rise to pain and joint-trouble.

Besides having these variations in size or in position, these growths may be single or multiple.

Out of the numerous specimens of these growths to be seen in the various museums, I shall only refer to two or three of the curious ones.

In the museum of Charing Cross Hospital is a beautiful specimen of a pedunculated growth removed by Mr. Bloxam. The pedicle was many times twisted, and before removal had frequently caused troublesome symptoms.

In the museum of the Middlesex Hospital is a knee-joint, showing a [illegible]lous growth. This

growth is firm and fibrous, and is one and a half inches in length. It hangs by a narrow neck from the posterior attachment of the internal semilunar cartilage to the head of the tibia, and lies upon the articular cartilages.

In the museum of the Royal College of Surgeons, I have seen a growth the pedicle of which was attached to the anterior crucial ligament in such a position as to be easily pinched between that ligament and the neighbouring condyle.

The symptoms and diagnosis of these disorders are very similar to those of a deranged internal semilunar cartilage; the patients (whether their cartilages be loose, pedunculated, multiple, or only single) also add that they have a sensation of something being loose in the joint, and that this "something" is very movable, often nipped, and then slipping away.

One of the symptoms which is most characteristic of all these varieties is, that the patient, while walking, is suddenly seized with a sharp sickening pain in the joint. The joint is not usually fixed as in displaced semilunar cartilages, for the loose cartilage is shot out of the joint by the act of pinching. This accident may be repeated several times in the course of one day, and is often followed by an attack of acute synovitis.

When the cartilage is pedunculated and is situated at the *upper part* of the joint, its presence usually gives rise to effusion induced by its movement and occasional attacks of vague pain, for the body is not able to be pinched between the articular cartilages, but only between the femur and the capsular ligament.

Other distinctions may be drawn: if the cartilage be a loose one, or be attached to the lower part of the joint, and is therefore pressed between the ends of the bones, the patient generally localises the pain to the interior of the joint or to the position of one of the semilunar cartilages; whereas, if the cartilage, being seated at the upper part of the articulation is only pinched (as explained above) between the femur and the capsule, the pain is usually assigned to the "point of pinch" or to the attachment of the cartilage, that is to say, the part upon which the pedicle drags.

If the cartilage is loose and of fair size, the patient will sometimes be able to find it or even fix it up in one of the synovial pouches; if there are several cartilages of moderate size, he will be able to recognise the fact that there are more than one. But if the cartilages are small, say of the melon-seed variety, the patient may be unable to

localise or even find them, and can rarely tell if there are many, or if there is one only.

If the cartilage be pedunculated and attached to the upper part of the joint, the patient will be able to discover that fact, and move the cartilage round in the radius of a circle, the fixed point being the centre.

A very different state of affairs exists if the cartilage be pedunculated, small, and attached to the lower part of the joint, or if there is only an enlarged and swollen fringe, or if the cartilage be seated in the centre of the articular surface of the tibia, as in the specimens described from the museums of the Royal College of Surgeons and of the Middlesex Hospital. In these cases there will be no possibility of feeling or diagnosing, without opening the joint, the presence of any definite loose body. The only symptom complained of will be that the pain is fixed to one part, either always at the same spot in the centre of the articulation, or to the front of the joint, either above or about the internal or external semilunar cartilage. The reference of the pain to the neighbourhood of these semilunar cartilages might lead the surgeon to suspect some derangement in either of them. Yet he might be able to tell that such was not the case, from the fact that, as far as he was able to

discover, there was no perceptible alteration in their substance, position, or movements. However, such a diagnosis would be very difficult, and such a mistake may be condoned, provided that the surgeon is always alive to what may exist or may be taking place within the joint.

The treatment of loose cartilages and of pedunculated cartilages or growths can be very well grouped together. In former days, the dangers of treating these states by the opening of the knee-joint were very much dreaded, and one or all of the following methods were tried, and may even now be tried, should the patient wish, before resorting to operation.

If the body is large enough to be felt, a piece of strapping should be taken and a hole cut in it. Into this hole the cartilage should be fitted and fixed, the joint at the same time being evenly strapped all over to keep the other parts quiet and pressed together, and so to prevent the cartilage from having space to slip about the cavity of the joint.

After the strapping, the leg should be bandaged on a splint. A blister, too, may be placed over the little piece of skin exposed by the hole in the strapping, in order that some inflammation may be set up which may extend to the synovial membrane

and thence to the cartilage. In this way, perhaps, the cartilage may become fixed.

Should the blistering fail, an attempt to obtain adhesion by the application of the actual cautery may be tried.

The above plan of treatment may succeed in cases in which the cartilage, if loose, can be pushed up to the upper part of the joint, or, if a pedunculated growth, can likewise be fixed to the upper portion; but when there are many growths, or if one is attached to the lower part of the joint, this method is not likely to be of much avail.

Should adherence of the cartilage to the synovial membrane have been obtained by the plan described, the patient, on leaving off the splint, should wear a rather strong elastic knee-cap, or a knee-cap with pads to fit the cartilage, so that it may not be torn away from its place of adherence. If the joint should become stiff from its enforced state of resting upon the splint, I strongly dissuade any forcible breaking down of adhesions if this were resorted to, the new attachment of the cartilage to the synovial membrane might be ruptured, and the patient be placed in the same condition as he was at first. He should be encouraged to move the limb gradually,

and then, in course of time, all adhesions interfering with the movements of the joint will give way or become stretched. If there are many loose cartilages, or if there is one pedunculated cartilage situated about the lower part of the joint; and when the above course of palliative treatment has failed, in cases fitted for such treatment, two modes of operative procedure are open to the surgeon, viz., the indirect and the direct method of removing these bodies from the joint.

The *indirect* method will receive only a brief description here, for I do not think it is one to be recommended. It is rather difficult to perform, is uncertain in its results, and no safer than the direct method when that is carefully and properly carried out.

It consists of the following. Previous to the administration of the anæsthetic, the leg should, as Mr. Howard Marsh advises, be placed on a splint and the knee alone exposed. Then, the cartilage being fixed by the assistant, a long-shaped tenotomy scalpel should be introduced into the joint at a distance of an inch and a-half from the cartilage, and be pressed on until its point touches the latter. The point of the knife should now be moved horizontally, the hilt being the

centre of a circle, of which the point describes the circumference. Thus the synovial membrane is divided, and a pocket is made in the sub-synovial tissue. Thereupon the knife is partly withdrawn, and the cartilage is pushed into the sub-synovial pocket, and allowed to adhere and rest there. At some subsequent time, when the synovial cut has healed, the cartilage may be removed.

There are several objections to this mode of procedure. It is sometimes difficult to push the cartilage into the sub-synovial fat, and even when pushed there it will not always remain in that position. Should the growth be pedunculated and the pedicle be strong, rupture of the attachment may be impossible, and thus the growth cannot be placed within the pocket. Moreover, when the lower part of the joint is being operated on, though the surgeon may think that he is dealing with a loose or a pedunculated body, it may really be a split or a partially detached semilunar cartilage.

Again, if the growth, though pedunculated, can be pulled into the pocket, by such a procedure the pedicle might be drawn across the condyle on its under surface, and so be pinched on every movement of the joint. The pain caused by this may be as severe as, nay, even more severe than

that occasioned by the pinching of the cartilage itself. Before, the pain was only intermittent, and occurred when the cartilage became nipped between the ends of the bones; but on the cartilage slipping away again, the trouble ceased. Now, however, the cartilage being placed in its pocket and fixed at both extremities, it cannot slip away from the condyle, and its pedicle, being drawn across the end of the latter, may give rise to constant pain. Finally, the method is useless when the cartilages are, or are likely to be, numerous.

The *direct* method, as usually performed, consists in cutting into the joint directly upon the cartilage, and squeezing it out through the incision, and then immediately sewing up the skin. Such a course is not a scientific or a proper one to pursue. No one now would ever dream of cutting into the abdominal cavity, squeezing out an ovary, ligaturing and cutting it off, and then merely putting stitches through the skin portion of the abdominal wound. The result would be that, as the peritonial surfaces had not been carefully brought together, serum, blood, or even pus could leak into the abdominal cavity, and cases would be lost. The same holds good of the knee, and no doubt accounts for some of the cases

of suppuration in the joint after the simple removal of a loose body.

It is not wise to have the limb fixed beforehand, for it may be necessary to manipulate it during the operation.

The joint should be deliberately cut down upon on to the cartilage by a vertical incision quite 1½ inches long; in particular, when the body is loose and at the middle of the joint, the incision should not be a small one through which the cartilage can only just be squeezed, but one of such a length that the synovial edges can be seen, and included in, and exactly brought together by the sutures. The details of opening the joint should be precisely the same as those used for operating upon a deranged semilunar cartilage.

This direct incision possesses several advantages. It is a more certain mode of treatment, inasmuch as the cartilage is removed. When pedunculated, the size and extent of the pedicle can be observed, and, if seated at the lower part of the joint, the pedicle can be cut short.

Again, should the diagnosis be obscure, any body, whether loose or pedunculated cartilage, detached or split semilunar cartilage, or even a ligamentum alarium, can be easily made out by the insertion of a finger into the joint. Thus the

ailment can be satisfactorily treated according to the circumstances of the case.

When a loose body cannot be found on commencing to operate, or if more than one are expected, it is best to open the joint by the incision used for treating the external semilunar cartilage. For then, with the leg flexed on the thigh and rotated inwards, a good view can be obtained, and, with the leg extended, the finger can thoroughly explore the joint, and, indeed, search almost every crevice.

If even a thorough search with the finger has failed to discover the nature and position of the bodies, it is well to try forcible irrigation of the joint. The irrigator being raised to some considerable height, the edges of the wound should be held together, and the joint forcibly distended with fluid. The wound should then be suddenly opened, and the lotion allowed to flow out of the joint with a rush. This powerful stream will wash out any loose bodies. After one or two have thus passed out, it is wise to continue the irrigation for some minutes longer, to make sure that no more remain within. Moreover, the nozzle of the irrigator should be moved about, over, and into every crevice of the joint.

Carbolic lotion (1 in 40, and slightly warmed) should be used.

Sometimes, without the need of this irrigation process, the finger may detect some short and small pedunculated bodies, in fact, approaching to the condition of villous fringes. These may be scratched away with the finger-nail, or removed by a rather blunt curette. It is especially advisable to do this when the bodies are in places where they are liable to be pinched, *e.g.*, around the patella, or on the lower half of the synovial membrane, where they may be caught between the ends of the bones, or between the bones and the semilunar cartilages.

When they have been scratched loose, they should be washed out of the joint in the manner just described.

If the case has been a simple one, *e.g.*, the removal of only one loose cartilage, it is not necessary to employ drainage; but if there has been thorough exploration of the joint, and much scratching away of bodies, or a great amount of washing out, it is wise to insert a small drainage-tube at the lower part of the wound.

The splints and dressings requisite are the same as those used for the semilunar cartilages.

I do not propose to relate any cases of removal

of these loose cartilages and pedunculated bodies. So very many have been reported by surgeons that it would be an invidious task for me to attempt to select any particular instances, and the narration of all of them would occupy far too much space.

The point of most moment is how such bodies can be removed in the safest and most efficacious manner, and that I have already striven to make clear.

We now come to villous fringes. The villous condition of the synovial membrane may spring from a remote attack of acute rheumatism or gout, or traumatism, giving rise to acute synovitis. In some cases the hyperæmia exercises a strongly-formative power in the production of very greatly hypertrophied fringes. When once the fringes have been formed by the acute diseases (although the acute diseases have been almost entirely forgotten through the lapse of time), they may increase the surface for secretion, and hence occasion an excess of fluid in the joint. Patches of the synovial membrane may become shaggy. The villi may be branched and ramified in all directions; they may be silky in nature, in some instances they may be slightly bulbed at the extremities, but not sufficiently so to become

absolutely pedunculated cartilages. Each fringe contains an artery and a vein, but these are lacking in the smaller twigs.

When these fringes are once formed, they may grow larger in consequence of the effusion they themselves create.

It is almost impossible to diagnose these conditions, except that in some cases the irritation keeps up a chronic synovitis in the joint.

The presence of a fringe may occasionally be diagnosed by pressing deeply on some tender spot. A soft crepitating may then be felt, described by Mr. Barwell as silken crepitus. This will be of a finer or coarser quality according to the smaller or larger size of the fringe. Sometimes when fluctuating, the hand will experience a sensation of movement as the wave passes from place to place. This current is certainly not due to the motion of a pure fluid, but may be caused by the passage under the fingers of these villous fringes.

Generally, as these bodies cannot be felt, the joints are not opened, no search is made, the conditions are not found, and are consequently not treated.

Not unfrequently, when the joints grate, the case is at once said to be one of chronic rheumatic

arthritis, and no attempt is made to discover whether it really is so or not.

In the healthy in whom such a condition is presumed to exist, or at all events in cases in which there is considerable discomfort in the knee, if palliative measures have failed, an exploration is quite justifiable in order that, should such a state exist, the patient may have the chance of being freed of the cause of trouble.

CHAPTER VI.

HYDROPS ARTICULI.

It may be said that the disorder, hydrops articuli, which forms the heading of this chapter, should not have been included in this book. Still, in my student-days I saw many cases of hydrops articuli; they were described to me as being dropsies of the knee-joint, which were due not to a constitutional disease but to some condition which was not clearly understood. What made most impression on me was the statement that these dropsies were often incurable. Such an assertion led me to entertain the desire that some day or other I might be able to discover a mode of permanently curing this not dangerous but sometimes very troublesome condition. Troublesome it surely is: for patients may suffer for years from these distended joints, which occasion such great slackening and stretching of the ligaments that the joints may be rendered at first unsafe and finally almost useless.

Curators of museums have generally assured me that specimens of these dropsical joints are of little curiosity, inasmuch as they show practically nothing. One or two of the specimens I saw had been preserved only for the purpose of showing the cause of the dropsy in the shape of villous fringes or growths. But these were not the object of my search; I wished to study specimens which to the naked eye showed no such hypertrophied fringes as may and often do account for the dropsy. Such fringes may not only cause the dropsy to originate, but may also keep it up by their continued existence; with their removal the disease may be cured. These fringes were spoken of in the preceding chapter, and my subject here will be what I may term, pure hydrops articuli.

The desired specimens not being forthcoming, except one beautiful one in the Royal College of Surgeons' Museum, I have consulted Mr. Barwell's excellent description of the disease, which is far and away the best account I have met with. In Mr. Barwell's words, "Hydrops articuli may (1) begin in a demonstrable inflammation, or (2) may begin without demonstrable inflammation and continue without further change than the thickening caused by the presence of the fluid."

He goes on to say that many cases of joint

dropsy follow immediately (and others more remotely) after acute synovitis. Sometimes, indeed, there is strong reason to believe that two parts of the inflamed synovial membrane adhere together. This idea may be confirmed clinically by observing that, in the early stages of the affection, the patient refers a frequent and sharp pain to a spot which is not commonly the seat of such a sensation. This, by exercising a certain friction on the point of attachment, may produce a congestion or distension of the vessels favourable to the effusion of much fluid. However, it must be admitted that in many cases there is no sign of and no reason to suspect the presence of any adhesion which might afterwards become a band. The inflammation, whether more or less antecedent, appears to have changed the secreting or the absorbing functions of the synovial membrane, and to have produced a congestion which is often extremely well marked after death, and is either general or in patches. The latter condition is the more common, except in old cases. Mr. Barwell had the opportunity of examining several cases of this affection. In one instance the ailment had begun with acute synovitis, and at the time of examination had been quiescent for fifteen months; in two other cases there had been respectively four and more than

seven years of chronic disease, and an abnormal amount of fluid was found in the joint. Moreover, in the first case there was considerable redness of the whole synovial membrane, which was very marked in the folds on each side of the patella, and in one point of the sub-crural sac was a spot of extreme hyperæmia. The fringes, especially around the patella, were a little more evident than usual, and, hanging by a narrow stalk from the crucial ligaments, was a little hygroma. In Mr. Barwell's opinion, the excessive congestion in the sub-crural prolongation was probably the cause of the super-secretion, and the other changes merely secondary.

In the other cases, which were more chronic, and in which inflammation had been more constant, a remarkable condition of the synovial membrane was discovered. The fluid in the joint was very yellow, albuminous, lubricating, but not thready, and the cut edge of the synovial membrane exhibited a yellow pulp not unlike that of an over-ripe orange. This pulp, where most developed, was in the older case one and a half inches, in the less old three-fourths of an inch thick. It was soaked in, and probably derived its colour from a similar fluid to that in the joint cavity, as its substance consisted of a great number of small chambers communicating freely with one another,

and varying from a microscopic size to such as would contain a No. 4 shot.

The inner surface was composed of rounded or conical eminences projecting from one-eighth to one-fourth of an inch, of about the same diameter, and placed well together. This mass was surrounded by a dense bluish-white capsule, looking like condensed fascia or tendon. The thickness was half an inch on an average, but varied in different parts. There was no external ligament except the capsule; and the crucial ligaments were much elongated and loose.

Mr. Barwell's conclusion was that mere passive congestion from venous obstruction does not produce hydrarthritis; in other words, that the latter is not really part of a general dropsy; the efficient cause is capillary active hyperæmia. After acute synovitis, this vascular condition is probably localized in one or more spots of the synovial membrane; but when the thickness is from the commencement chronic and non-inflammatory, the hyperæmia is more general, and tends, together with the effect of soakage, to a peculiar hypertrophy of the endothelium and of the immediately subjacent layer of the tissue—viz., the synovial intima.

The above conditions are clearly different from

what follows rheumatism, when the fringes have become hypertrophied.

Some have hinted that the ailment is tubercular in nature, the tubercule being very chronic, and leading only to persistent hypertrophy of the synovial membrane.

I think a more reasonable solution of the problem is, that hydrops articuli is, like a hydrocele in the scrotum, due, not to any constitutional disease, but rather to a want of balance between the secretion and absorption of the fluids thrown out; in other words, there is a super-secretion of fluid or a diminished power of absorption.

The fluid in the joint may be unctuous and viscid like synovia, of a yellowish colour, and with the density of oil; or it may be reddish, and occasionally serous.

Its appearance is usually manifested in the shape of a soft tumour, accompanied with fluctuation, but with no change of colour of the skin, and no local increase in temperature. This tumour is indolent and scarcely painful; it yields to the pressure of the finger, but does not retain the impression as in œdema. The swelling exactly occupies the reflexions of the synovial membrane.

A diagnosis can be made from its extreme chronicity, from the sense of fluctuation, and from

the fact that the patella floats; that is to say, when the finger is placed on the patella, it immediately touches that bone, which on further pressure can be pushed down on to the condyles of the femur, only to bound up again in consequence of the distended condition of the joint.

At first very few symptoms may be complained of, but later on the distension may cause a stretching of the ligaments and a weakening of the joint, which may, indeed, become so considerable as to permanently cripple the patient.

There are various modes of treating hydrops articuli.

When the affection is of a fairly recent origin, the joint should be fixed in splints, and thus, no movement being allowed, the synovial membrane may be enabled to rest. It is also wise to apply a Martin's bandage to the joint, so that an equal pressure may be exerted and the process of absorption hastened.

If no good results accrue, there are several other methods from which to choose.

Blisters may be employed, a counter-irritation may be set up by the application of the actual cautery, the joint may be daily subjected to massage, or rubbed every morning with ung. hydrag. biniodide. Another mode is to cover the joint

with Scott's ointment and carefully strap it; this may stop the excessive secretion, and promote the absorptive power of the synovial membrane. The joint, too, may be aspirated and then strapped.

American surgeons, and in particular, Dr. MacDonnell, strongly urge that the fluid should be partially withdrawn, and that the joint should be injected with a solution of iodine (two drachms) and lukewarm water (two drachms). This sets up some little inflammation (as it does in hydrocele). This may cure the dropsy of the joint, and was exceedingly successful when tried by Dr. MacDonnell. He lost no cases, and considers the treatment to be very valuable, and likely to cure pure, uncomplicated, chronic hydrops.

Incurable cases may have arisen from the villous fringes previously referred to, which, from the irritation they cause, may renew the secretion, occasion a regeneration of the fluid after it has once been removed, and reproduce the hydrops condition.

Now, if after bandaging, splinting, blistering, aspiration, the application of iodine injections, and so forth, no good has been obtained, an attempt should be made to discover enlarged fringes. If any are felt, the case is not one of pure hydrops;

no time should be lost in palliative treatment, and the joint should be opened for the removal of the fringes.

But even if no fringes have been felt in cases where all the above enumerated methods have failed, I would still suggest that an incision be made into the joint. This, I think, had better be made into the large synovial pouch on the inner side of the knee, beginning on a level with the middle of the patella, about three-fourths of an inch from its inner border, and continued upwards for about two inches. If on exploration with the finger no bands of adherent membrane or attached fringes are discovered, the joint should be forcibly irrigated, so that any melon-seed bodies, occasioning the fluid, may be found and washed out. None of these being present, it is now clearly established that the case is one of pure hydrops.

I should now adopt a method similar to the treatment of hydrocele or of chronic peritonitis by constant drainage. I should sew up the greater part of the wound, bringing the synovial edges carefully together, and at the same time leave in the lower angle a non-compressible drainage-tube, say, made of coraline. The leg being carefully bandaged on to a splint so as to prevent all move-

ment, the outer end of the tube should be allowed to rest in a mass of carbolised gauze.

The tube should remain in for at least ten days, or at all events till there is no discharge of synovia from the joint into the dressings; then, and not till then, should it be removed.

This treatment by drainage has succeeded, not only in hydrocele, which is a super-secretive disease, but also in chronic peritonitis, which is tubercular; as in both these conditions the dropsy has been cured, the same happy result might be attained in cases of what is considered to be incurable hydrops articuli. The method is, at any rate, I think, worthy of trial.

A case is reported in which Mr. Willett opened and drained a joint in the following manner:

"Under antiseptic precautions, an incision, two inches long, was made from the centre of the outer border of the patella, directly upwards into the joint. A second incision was made for the same distance downwards along the inner border of the patella; and a third one, of the same length, at the outer and back part of the knee, from the head of the fibula to the inner border of the tendon of the biceps in an upward direction. The joint was washed out with carbolic lotion, and the synovial membrane scraped and

afterwards cleansed with a solution of chloride of zinc (10 gr. to 1 drachm). Drainage-tubes were inserted, and the limb put upon a straight back splint. In five weeks all the tubes were removed, and in another week the wounds were nearly closed, and the patient could lift his leg without pain. Two months later there was no fluid in the joint, but the synovial membrane was somewhat thickened. The patient could flex his leg to an angle of 30°, and could walk with the aid of crutches. Some months afterwards he was found to have retained a very useful joint, free from swelling, and possessed of considerable movement."

This case is very interesting, but the treatment, I think, was rather severe; it should only be resorted to after the method of drainage I have recommended has had a fair trial.

Indeed, it is doubtful whether it would not be safer to allow the patient, especially if elderly, to wear a splint for the rest of his life; for so severe a course of treatment might lead to the loss of the limb.

In drawing this little work to a close, I am aware that many readers may say, "All this is nothing more than what we have known before." That may be true, but a collection of cases, not

only from my own experience, but from that of others, may be not without some value. I am bold enough to hope that the conclusions I have arrived at may serve to exhibit these internal derangements of the knee-joint in a somewhat better light, and that a clearer understanding of these maladies may enable them to receive a more prompt and efficacious treatment.

The operative procedures I have recommended may be termed heroic, rash, hazardous, uncalled for, and so forth; but the same cry has always been raised when new departures have been proposed. Because these derangements of the knee-joint do not cause death, but only some pain and much discomfort, patients, forsooth, should be life-long sufferers, be debarred from many enjoyments, and perhaps even be prevented from working. Now, however, that the operations proposed have been shown to be fraught with little danger, these troublesome and often crippling derangements may be promptly cured.

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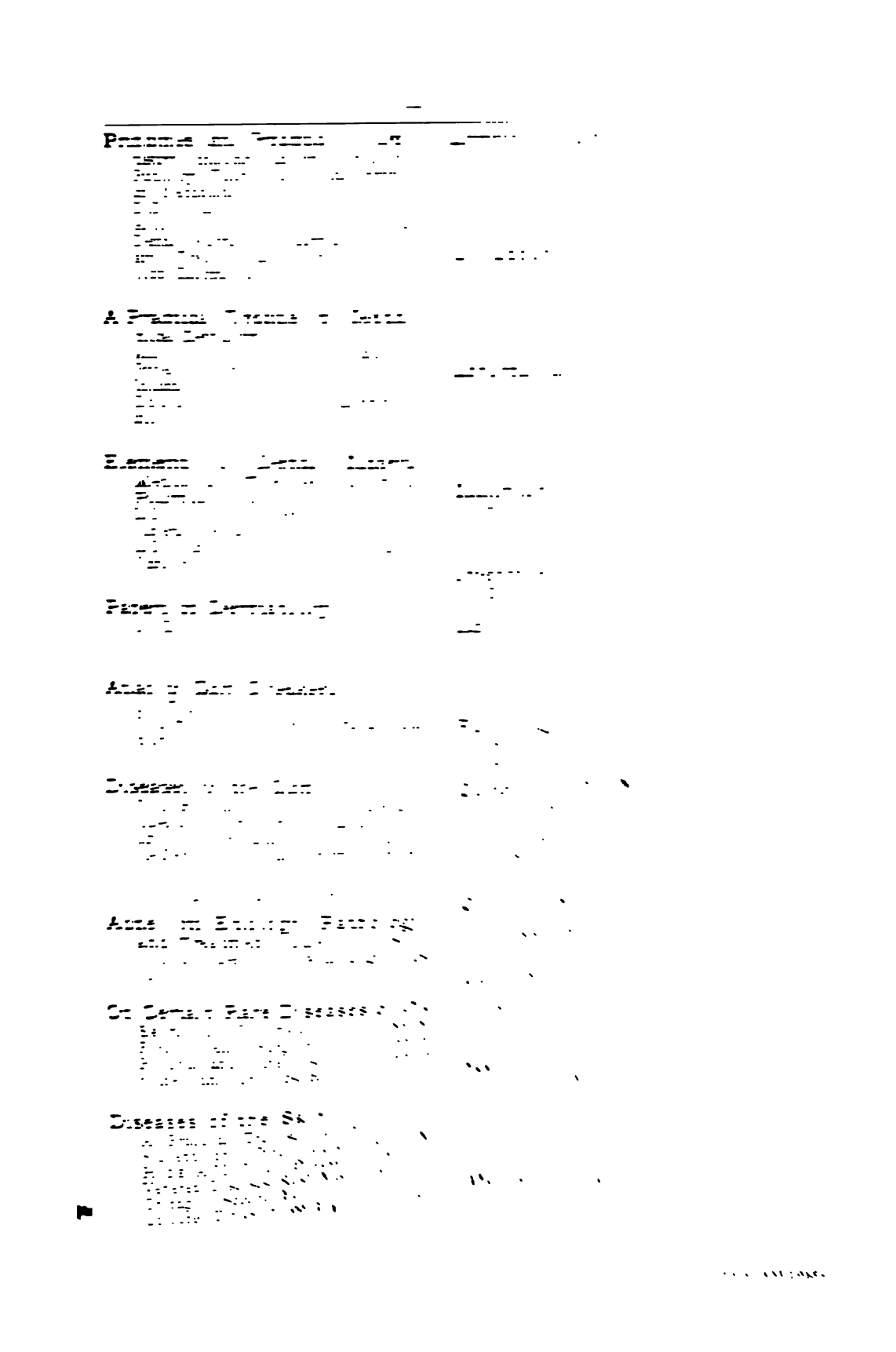

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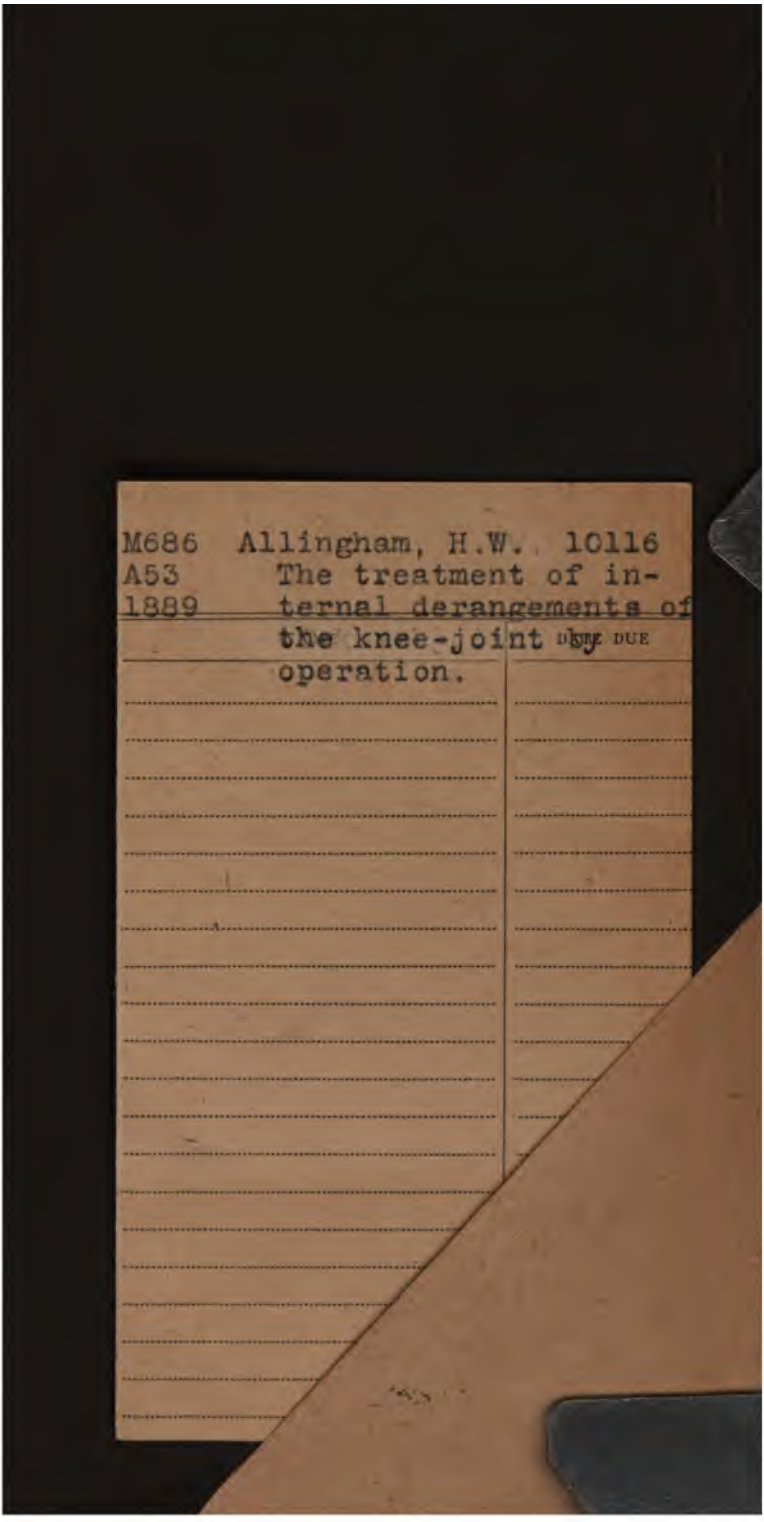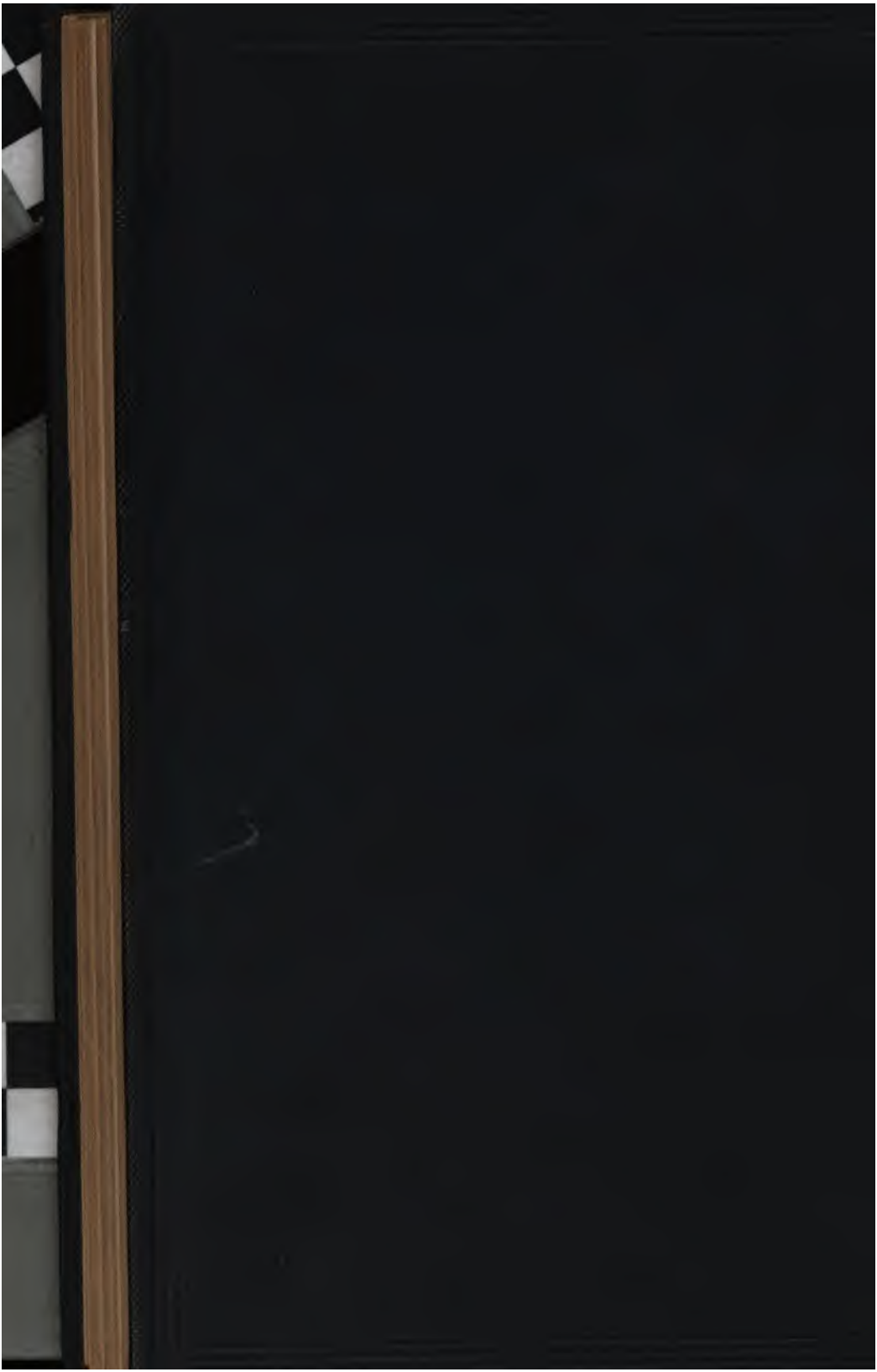
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